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THE

JOHNS HOPKINS HOSPITAL

BULLETIN

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THE JOHNS HOPKINS HOSPITAL

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THE MASTER-WORD IN MEDICINE.[1]

BY WILLIAM OSLER, M. D., F. R. S.,

Professor of Medicine, Johns Hopkins University, Baltimore, Md.

I.

Before proceeding to the pleasing duty of addressing the undergraduates, as a native of this province and as an old student of this school, I must say a few words on the momentous changes inaugurated with this session, the most important, perhaps, which have taken place in the history of the profession in Ontario. The splendid laboratories, which we saw opened this afternoon, a witness to the appreciation by the authorities of the needs of science in medicine, make possible the highest standards of education in the subjects upon which our Art is based. They may do more. A liberal policy, with a due regard to the truth that the greatness of a school lies in brains, not bricks, should build up a great scientific center which will bring renown to this city and to our country. The men in charge of the departments are of the right stamp. See to it that you treat them in the right way by giving skilled assistance enough to ensure that the vitality of men who could work for the world is not sapped by the routine of teaching. One regret will, I know, be in the minds of many of my younger hearers. The removal of the departments of anatomy and physiology from the biological laboratory of the university breaks a connection which has had an important influence on medicine in this city. To Professor Ramsay Wright is due much of the inspiration which has made possible these fine new laboratories. For years he has encouraged in every way the cultivation of the scientific branches of medicine, and has unselfishly devoted much time to promoting the best interests of the Medical Faculty. And in passing let me pay a tribute to the ability and zeal with which Dr. A. B. Macallum has won for himself a world-wide reputation by intricate studies which have carried the name of this University to every nook and corner of the globe where the science of physiology is cultivated. How much you owe to him in connection with the new buildings I need scarcely mention to this audience.

But the other event which we celebrate is of much greater importance. When the money is forthcoming, it is an easy matter to join stone to stone in a stately edifice, but it is hard to find the market in which to buy the precious cement which can unite into an harmonious body the professors of medicine of two rival medical schools in the same city. That this has been accomplished so satisfactorily is a tribute to the good sense of the leaders of the two faculties, and tells of their recognition of the needs of the profession of the province.

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[1] An address to medical students on the occasion of the opening of the new buildings of the Medical Faculty of the University of Toronto, October 1st, 1903.

Is it too much to look forward to the absorption or affiliation of the Kingston and London schools into the Provincial University? The day has passed in which the small school without full endowment can live a life beneficial to the students, to the profession, or to the public. I know well of the sacrifice of time and money which is freely made by the teachers of those schools; and they will not misunderstand my motives when I urge them to commit suicide, at least so far as to change their organizations into clinical schools in affiliation with the central university as part, perhaps, of a widespread affiliation of the hospitals of the province. A school of the first rank in the world, such as this must become, should have ample clinical facilities under its own control. It is as much a necessity that the professors of medicine and surgery, etc., should have large hospital services under their control throughout the year, as it is that professors of pathology and physiology should have laboratories such as those in which we here meet. It should be an easy matter to arrange between the provincial authorities and the trustees of the Toronto General Hospital to replace the present antiquated system of multiple small services by modern well-equipped clinics—three in medicine and three in surgery to begin with. The increased efficiency of the service would be a substantial *quid pro quo*, but there would have to be a self-denying ordinance on the part of many of the attending physicians. With the large number of students in the combined school, no one hospital can furnish in practical medicine, surgery and the specialties a training in the art an equivalent of that which the student will have in the sciences in the new laboratories. An affiliation should be sought with every other hospital in the city and province of fifty beds and over, in each of which two or three extra-mural teachers could be recognized who would receive for three or more months a number of students proportionate to the beds in the hospital. I need not mention names. We all know men in Ottawa, Kingston, London, Hamilton, Guelph and Chatham, who could take charge of small groups of the senior students and make of them good practical doctors. I merely throw out the suggestion. There are difficulties in the way; but is there anything in this life worth struggling for which does not bristle with them?

Students of medicine: may this day be to each one of you, as it was to me when I entered this school thirty-five years ago, the beginning of a happy life in a happy calling. Not one of you has come here with such a feeling of relief as that which I experienced at an escape from conic sections and logarithms and from Hooker and Pearson. The dry bones became clothed with interest, and I felt that I had at last got to work. Of the greater advantages with which you start I shall not speak. Why waste words on what you cannot understand. To those only of us who taught and studied in the dingy old building which stood near here is it given to feel the change which the years have wrought—a change which my old teachers, whom I see here to-day—Dr Richardson, Dr. Ogden, Dr. Thorburn and Dr. Oldright—must find hard to realize. One looks about in vain for some accustomed object on which to rest the eye in its backward glance—all, all are gone; the old familiar places. Even the landscape has altered, and the sense of loneliness and regret, the sort of homesickness one experiences on such occasions, is relieved by a feeling of thankfulness that at least some of the old familiar faces have been spared to see this day. To me at least the memory of those happy days is a perpetual benediction, and I look back upon the two years I spent at this school with the greatest delight. There were many things that might have been improved—and we can say the same of every medical school at that period—but I seem to have gotten more out of it than our distinguished philosopher friend, J. Beattie Crozier, whose picture of the period seems rather hardly drawn. But after all, as some one has remarked, instruction is often the least part of an education, and, as I recall them, our teachers in their life and doctrine set forth a true and lively word to the great enlightenment of our darkness. They stand out in the background of my memory as a group of men whose influence and example were most helpful. In William R. Beaumont and Edward Mulberry Hodder, we had before us the highest type of the cultivated English surgeon. In Henry H. Wright we saw the incarnation of faithful devotion to duty—too faithful, we thought, as we trudged up to the eight o'clock lecture in the morning. In W. T. Aikins a practical surgeon of remarkable skill and an ideal teacher for the general practitioner. How we wondered and delighted in the anatomical demonstrations of Dr. Richardson, whose infective enthusiasm did much to make anatomy the favorite subject among the students. I had the double advantage of attending the last course of Dr. Ogden and the first of Dr. Thorburn on materia medica and therapeutics. And Dr. Oldright had just begun his career of unselfish devotion to the cause of hygiene.

To one of my teachers I must pay in passing the tribute of filial affection. There are men here to-day who feel as I do about Dr. James Bovell—that he was one of those finer spirits, not uncommon in life, touched to finer issues only in a suitable environment. Would the Paul of evolution have been Thomas Henry Huxley had the Senate elected the young naturalist to a chair in this university in 1851? Only men of a certain metal rise superior to their surroundings, and while Dr. Bovell had that all-important combination of boundless ambition with energy and industry, he had that fatal fault of diffuseness, in which even genius gets strangled. With a quadrilateral mind, which he kept spinning like a teetotum, one side was never kept uppermost for long at a time. Caught in the storm which shook the scientific world with the publication of the "Origin of Species," instead of sailing before the wind, even were it with bare poles, he put about and sought a harbor of refuge in writing a work on Natural Theology, which you will find on the shelves of second-hand bookshops in a company made respectable at least by the presence of Paley. He was an omniverous reader and transmuter, he could talk pleasantly, even at times transcendentally, upon anything in the science of the day, from protoplasm to evolution; but he lacked concentration and that scientific accuracy which only comes with a long training (sometimes indeed never comes), and which is the ballast of the boat. But the bent of his mind was devotional, and early swept into the Tractarian movement, he became an advanced Churchman, a good Anglican Catholic. As he chaffingly remarked one day to his friend, the Reverend Mr. Darling, he was like the waterman in "Pilgrim's Progress," rowing one way, towards Rome, but looking steadfastly in the other direction, towards Lambeth. His "Steps to the Altar," and his "Lectures on the Advent" attest the earnestness of his convictions; and later in life, following the example of Linacre, he took orders and became another illustration of what Cotton Mather calls the angelical conjuction of medicine with divinity. Then, how well I recall the keen love with which he would engage in metaphysical discussions, and the ardor with which he studied Kant, Hamilton, Reed and Mill. At that day to the Rev. Prof. Bevan was entrusted the rare privilege of directing the minds of the thinking youths at the Provincial University into proper philosophical channels. It was rumored that the hungry sheep looked up and were not fed. I thought so at least, for certain of them, led by T. Wesley Mills, came over daily after Dr. Bovell's four o'clock lecture to reason high and long with him

> "On Providence, Foreknowledge, Will and Fate—
> Fixed Fate, Freewill, Foreknowledge absolute."

Yet withal his main business in life was as a physician, much sought after for his skill in diagnosis, and much beloved for his loving heart. He had been brought up in the very best practical schools. A pupil of Bright and of Addison, a warm personal friend of Stokes and of Graves, he maintained loyally the traditions of Guy's and taught us to reverence his great masters. As a teacher, he had grasped the fundamental truth announced by John Hunter of the unity of physiological and pathological processes, and, as became the occupant of the chair of the Institute of Medicine, he would discourse on pathological processes in lectures on physiology, and illustrate the physiology of bioplasm in lectures on the pathology of tumors to the bewilderment of the students. When in September, 1870, he wrote to me that he did not intend to return from the West Indies, I felt that I had lost a father and a friend; but in Robert Palmer Howard, of Montreal, I found a noble step-father, and to these two men, and to my first teacher, the Rev. W. A. Johnson, of Weston, I owe my success in life—if success means getting what you want and being satisfied with it.

II.

Of the value of an introductory lecture I am not altogether certain. I do not remember to have derived any enduring benefit from the many that I have been called upon to hear, or from the not a few I have inflicted in my day. On the whole I am in favor of abolishing the old custom, but as this is a very special occasion, with special addresses, I consider myself most happy to have been selected for this part of the programme. To the audience at large I fear that much of what I have to say will appear trite and commonplace, but bear with me, since, indeed, to most of you how good soever the word, the season is long past in which it could be spoken to your edification. As I glance from face to face the most striking single peculiarity is the extraordinary diversity that exists among you. Alike in that you are men and white, you are unlike in your features, very unlike in your minds and in your mental training, and your teachers will mourn the singular inequalities in your capacities. And so it is sad to think will be your careers. For one success, for another failure; one will tread the primrose path to the great bonfire, another the straight and narrow way to renown; some of the best of you will be stricken early on the road, and will join that noble band of youthful martyrs who loved not their lives to the death; others, perhaps the most brilliant among you, like my old friend and comrade, Dick Zimmerman (how he would have rejoiced to see this day!), the Fates will overtake and whirl to destruction just as success seems assured. When the iniquity of oblivion has blindly scattered her poppy over us, some of you will be the trusted counsellors of this community, and the heads of departments in this Faculty while for the large majority of you, let us hope, is reserved the happiest and most useful lot given to man—to become vigorous, whole-souled, intelligent general practitioners.

It seems a bounden duty on such an occasion to be honest and frank, so I propose to tell you the secret of life as I have seen the game played, and as I have tried to play it myself. You remember in one of the "Jungle Stories," that when Mowgli wished to be avenged on the villagers he could only get the help of Hathi and his sons by sending them the master-word. This I propose to give you in the hope, yes, the full assurance, that some of you at least will lay hold upon it to your profit. Though a little one, the master-word looms large in meaning. It is the open sesame to every portal, the great equalizer in the world, the true philosopher's stone which transmutes all the base metal of humanity into gold. The stupid man among you it will make bright, the bright man brilliant, and the brilliant student steady. With the magic word in your heart all things are possible, and without it all study is vanity and vexation. The miracles of life are with it; the blind see by touch, the deaf hear with eyes, the dumb speak with fingers. To the youth it brings hope, to the middle-aged confidence, to the aged repose. True balm of hurt minds, in its presence the heart of the sorrowful is lightened and consoled. It is directly responsible for all advances in medicine during the past twenty-five centuries. Laying hold upon it, Hippocrates made observation and science the warp and woof of our art. Galen so read its meaning that fifteen centuries stopped thinking, and slept until awakened by the *De Fabrica* of Vesalius, which is the very incarnation of the master-word. With its inspiration Harvey gave an impulse to a larger circulation than he wot of, an impulse which we feel to-day. Hunter sounded all its heights and depths, and stands out in our history as one of the great exemplars of its virtues. With it Virchow smote the rock and the waters of progress gushed out; while in the hands of Pasteur it proved a very talisman to open to us a new heaven in medicine and a new earth in surgery. Not only has it been the touchstone of progress, but it is the measure of success in everyday life. Not a man before you but is beholden to it for his position here, while he who addresses you has that honor directly in consequence of having had it graven on his heart when he was as you are to-day. And the Master-Word is *Work*, a little one, as I have said, but fraught with momentous sequences if you can but write it on the tables of your heart, and bind it upon your forehead. But there is a serious difficulty in getting you to understand the paramount importance of the work-habit as part of your organization. You are not far from the Tom Sawyer stage with its philosophy " that work consists of whatever a body is obliged to do, and play consists of whatever a body is not obliged to do."

A great many hard things may be said of the work-habit. For many of us it means a hard battle; the few take to it naturally; the many prefer idleness and never learn to love to labor. Listen to this: " Look at one of your industrious fellows for a moment, I beseech you," says Robert Louis Stevenson. " He sows hurry and reaps indigestion; he puts a vast deal of activity out to interest, and receives a large measure of nervous derangement in return. Either he absents himself entirely from all fellowship, and lives a recluse in a garret, with carpet slippers and a leaden inkpot; or he comes among people swiftly and bitterly, in a contraction of his whole nervous system, to discharge some temper before he returns to work. I do not care how much or how well he works, this fellow is an evil feature in other people's lives." These are the sentiments of an overworked, dejected man; let me quote the motto of his saner moments: " To travel hopeful is better than to arrive, and the true success is in labor." If you wish to learn of the miseries of scholars in order to avoid them, read Part I, Section 2, Member 3, Sub-section XV, of that immortal work, the "Anatomy of Melancholy," but I am here to warn you against these evils, and to entreat you to form good habits in your student days.

At the outset, appreciate clearly the aims and objects each one of you should have in view—a knowledge of disease and its cure, and a knowledge of yourselves. The one, a special education, will make you a practitioner of medicine; the other, an inner education, may make you a truly good man, foursquare and without a flaw. The one is extrinsic and is largely accomplished by teacher and tutor, by text and by tongue; the other is intrinsic and is the mental salvation to be wrought by each one for himself. The first may be had without the second; any one of you may become an active practitioner, without ever having had sense enough to realize that through life you have been a fool; or you may have the second without the first, and, without knowing much of the art, you may have the endowments of head and heart that make the little you do possess go very far in the community. With what I hope to infect you is the desire to have a due proportion of each.

So far as your professional education is concerned, what I shall say may make for each one of you an easy path easier. The multiplicity of the subjects to be studied is a difficulty, and it is hard for teacher and student to get a due sense of proportion in the work. We are in a transition stage in our methods of teaching, and we have not everywhere got away from the idea of the examination as the " be-all and end-all; " so that the student has continually before his eyes the magical letters of the degree he seeks. And this is well, perhaps, if you will remember that having, in the old phrase, commenced Bachelor of Medicine, you have only reached a point from which you can begin a life-long process of education.

So many and varied are the aspects presented by this theme that I can only lay stress upon a few of the more essential. The very first step towards success in any occupation is to become interested in it. Locke put this in a very happy way when he said, give a pupil " a relish of knowledge " and you put life into his work. And there is nothing more certain than that you cannot study well if you are not interested in your profession. Your presence here is a warrant that in some way you have become attracted to the study of medicine, but the speculative possibilities so warmly cherished at the outset are apt to cool when in contact with the stern realities of the class-room. Most of you have already experienced the all-absorbing attraction of the scientific branches, and nowadays the practical method of presentation has given a zest which was usually lacking in the old theoretical teaching. The life has become more serious in consequence, and medical students have put away many of the childish tricks with which we used to keep up their bad name. Compare the picture of the " sawbones " of 1842, as given in the recent biography of Sir Henry Acland, with their representatives to-day, and it is evident a great revolution has been effected, and very largely by the salutary influence of improved methods of education. It is possible now to fill out a day with practical work, varied enough to prevent monotony, and so arranged that the knowledge is picked out by the student himself, not trust into him, willy-nilly, at the point of the tongue. He exercises his wits, and is no longer a passive Strassbourg goose, tied up and stuffed to repletion.

How can you take the greatest possible advantage of your capacities with the least possible strain? By cultivating system. I say cultivating advisedly, since some of you will find the acquisition of systematic habits very hard. There are minds congenitally systematic; others have a life-long fight against an inherited tendency to diffuseness and carelessness in work. A few brilliant fellows try to dispense with it altogether, but they are a burden to their brethren and a sore trial to their intimates. I have heard it remarked that order is the badge of an ordinary mind. So it may be, but as practitioners of medicine we have to be thankful to get into this useful class. Let me entreat those of you who are here for the first time to lay to heart what I say on this matter. Forget all else, but take away this counsel of a man who has had to fight a hard battle, but not always a successful one, for the little order he has had in his life: take away with you a profound conviction of the value of system in your work. I appeal to the freshmen especially, because you to-day make a beginning, and your future career depends very much upon the habits you will form during this session. To follow the routine of the classes is easy enough, but to take routine into every part of your daily life is a hard task. Some of you will start out joyfully as did Christian and Hopeful, and for many days will journey safely towards the Delectable Mountains, dreaming of them and not thinking of disaster until you find yourselves in the strong captivity of Doubt and under the grinding tyranny of Despair. You have been over-confident. Begin again and more cautiously. No student escapes wholly from these perils and trials; be not disheartened, expect them. Let each hour of the day have its allotted duty, and cultivate that power of concentration which grows with its exercise, so that the attention neither flags nor wavers, but settles with a bull-dog tenacity on the subject before you. Constant repetition makes a good habit fit easily in your mind, and by the end of the session you may have gained that most precious of all knowledge—the power to work. Do not underestimate the difficulty you will have in wringing from your reluctant selves the stern determination to exact the uttermost minute on your schedule. Do not get too interested in one study at the expense of another, but so map out your day that due allowance is given to each. Only in this way can the average student get the best that he can out of his capacities. And it is worth all the pains and trouble he can possibly take for the ultimate gain—if he can reach his doctorate with system so ingrained that it has become an integral part of his being. The artistic sense of perfection in work is another much-to-be-desired quality to be cultivated. No matter how trifling the matter on hand, do it with a feeling that it demands the best that is in you, and when done look it over with a critical eye, not sparing a strict judgment on yourself. This it is that makes anatomy a student's touchstone. Take the man who does his "part" to perfection, who has got out all there is in it, who labors over the tags of connective tissue, and who demonstrates Meckel's ganglion in his part—this is the fellow in after years who is apt in emergencies, who saves a leg badly smashed in a railway accident, or fights out to the finish, never knowing when he is beaten, in a case of typhoid fever.

Learn to love the freedom of the student life, only too quickly to pass away; the absence of the coarser cares of after days, the joy of comradeship, the delight in new work, the happiness in knowing that you are making progress. Once only can you enjoy these pleasures. The seclusion of the student life is not always good for a man, particularly for those of you who will afterwards engage in general practice, since you will miss that facility of intercourse upon which often the doctor's success depends. On the other hand, sequestration is essential for those of you with high ambitions proportionate to your capacity. It was for such that St. Chrysostom gave his famous counsel, "Depart from the highways and transplant thyself into some enclosed ground, for it is hard for a tree that stands by the wayside to keep its fruit till it be ripe."

Has work no dangers connected with it? What of this bogey of overwork of which we hear so much? There are dangers, but they may readily be avoided with a little care. I can only mention two, one physical, one mental. The very best students are often not the strongest. Ill-health, the bridle of Theages, as Plato called it in the case of one of his friends whose mind had thriven at the expense of the body, may have been the diverting influence toward books or the profession. Among the good men who have studied with me there stand out in my remembrance many a young Lycidas, "dead ere his prime," sacrificed to carelessness in habits of living and neglect of ordinary sanitary laws. Medical students are much exposed to infection of all sorts, to combat which the body must be kept in first-class condition. Grosseteste, the great Bishop of Lincoln, remarked that there were three things necessary for temporal salvation—food, sleep, and a cheerful disposition. Add to these suitable exercise and you have the means by which good health may be maintained. Not that health is to be a matter of perpetual solicitude, but habits which favor the *corpus sanum* foster the *mens sana,* in which the joy of living and the joy of working are blended in one harmony. Let me read you a quotation from old Burton, the great authority on *morbi eruditorum.* There are "many reasons why students dote more often than others. The first is their negligence. Other men look to their tools: a painter will wash his pencils; a smith will look to his hammer, anvil, forge; a husbandman will mend his plough-irons, and grind his hatchet, if it be dull; a falconer or huntsman will have an especial care of his hawks, hounds, horses, dogs, etc.; a musician will string and unstring his lute, etc.; only scholars neglect that instrument, their brain and spirits (I mean) which they daily use."[2]

Much study is not only believed to be a weariness of the flesh, but also an active cause of ill-health of mind, in all grades and phase. I deny that work, legitimate work, has anything to do with this. It is that foul fiend Worry who is responsible for a large majority of the cases. The more carefully one looks into the cause of nervous breakdown in students, the less important is work *per se* as a factor. There are a few cases of genuine overwork, but they are not common. Of the causes of worry in the student life there are three of prime importance to which I may briefly refer.

An anticipatory attitude of mind, a perpetual forecasting, disturbs the even tenor of his way and leads to disaster. Years ago a sentence in one of Carlyle's essays made a lasting impression on me: "Our duty is not to *see* what lies dimly at a distance, but to *do* what lies clearly at hand." I have long maintained that the best motto for a student is, "Take no thought for the morrow." Let the day's work suffice; live for it, regardless of what the future has in store, believing that to-morrow should take thought for the things of itself. There is no such safeguard against the morbid apprehensions about the future, the dread of examinations and the doubt of ultimate success. Nor is there any risk that such an attitude may breed carelessness. On the contrary, the absorption in the duty of the hour is in itself the best guarantee of ultimate success. "He that regardeth the wind shall not sow, and he that observeth the clouds shall not reap," which means you cannot work profitably with your mind set upon the future.

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[2] Quotation mainly from Marsilius Ficinus.

Another potent cause of worry is an idolatry by which many of you will be sore let and hindered. The mistress of your studies should be the heavenly Aphrodite, the motherless daughter of Uranus. Give her your whole heart and she will be your protectress and friend. A jealous creature, brooking no second, if she finds you trifling and coquetting with her rival, the younger, early Aphrodite, daughter of Zeus and Dione, she will whistle you off, and let you down the wind to be a prey, perhaps to the examiners, certainly to the worm regret. In plainer language, put your affections in cold storage for a few years, and you will take them out ripened, perhaps a bit mellow, but certainly less subject to those frequent changes which perplex so many young men. Only a grand passion, an all-absorbing devotion to the elder goddess, can save the man with a congenital tendency to philandering, the flighty Lydgate who sports with Celia and Dorothea, and upon whom the judgment ultimately falls in a basil-plant of a wife like Rosamond.

And thirdly, one and all of you will have to face the ordeal of every student in this generation who sooner or later tries to mix the waters of science with the oil of faith. You can have a great deal of both if you can only keep them separate. The worry comes from the attempt at mixture. As general practitioners you will need all the faith you can carry, and while it may not always be of the conventional pattern, when expressed in your lives rather than on your lips, the variety is not a bad one from the standpoint of St. James, and may help to counteract the common scandal alluded to in the celebrated diary of that gossipy old parson-doctor, the Rev. John Ward: "One told the Bishop of Gloucester that he imagined physitians of all men the most competent judges of all others' affairs of religion—and his reason was because they were wholly unconcerned with it."

III.

Professional work of any sort tends to narrow the mind, to limit the point of view, and to put a hall-mark on a man of a most unmistakable kind. On the one hand are the intense, ardent natures, absorbed in their studies and quickly losing interest in everything but their profession, while other faculties and interests "fust" unused. On the other hand are the bovine brethren, who think of nothing but the treadmill and the corn. From very different causes, the one from concentration, the other from apathy, both are apt to neglect those outside studies that widen the sympathies and help a man to get the best there is out of life. Like art, medicine is an exacting mistress, and in the pursuit of one of the scientific branches, sometimes, too, in practice, not a portion of a man's spirit may be left free for other distractions, but this does not often happen. On account of the intimate personal nature of his work, the medical man, perhaps more than any other man, needs that higher education of which Plato speaks, "that education in virtue from youth upwards, which enables a man eagerly to pursue the ideal perfection." It is not for all, nor can all attain to it, but there is comfort and help in the pursiut, even though the end is never reached. For a large majority the daily round and the common task furnish more than enough to satisfy their heart's desire, and there seems no room left for anything else. Like the good, easy man whom Milton scores in the Areopagitica, whose religion was a "traffic so entangled that of all mysteries he could not skill to keep a stock going upon that trade," and handed it over with all the locks and keys to "a divine of note and estimation," so is it with many of us in the matter of this higher education. No longer intrinsic, wrought in us and ingrained, it has become, in Milton phrase, a "dividual movable," handed over nowadays to the daily press or to the hap-hazard instruction of the pulpit, the platform, or the magazines. Like a good many other things, it comes to a better and more enduring form if not too consciously sought. The all-important thing is to get a relish for the good company of the race in a daily intercourse with some of the great minds of all ages. Now, in the spring-time of life, pick your intimates among them, and begin a systematic cultivation of their works. Many of you will need a strong leaven to raise you above the level of the dough in which it will be your lot to labor. Uncongenial surroundings, an ever-present dissonance between the aspirations within and the actualities without, the oppressive discords of human society, the bitter tragedies of life, the *lacrymae rerum,* beside the hidden springs of which we sit in sad despair—all these tend to foster in some natures a cynicism quite foreign to our vocation, and to which this inner education offers the best antidote. Personal contact with men of high purpose and character will help a man to make a start—to have the desire, at least, but in its fulness this culture—for that word best expresses it—has to be wrought by each one for himself. Start at once a bed-side library and spend the last half hour of the day in communion with the saints of humanity. There are great lessons to be learned from Job and from David, from Isaiah and St. Paul. Taught by Shakespeare you may take your intellectual and moral measure with singular precision. Learn to love Epictetus and Marcus Aurelius. Should you be so fortunate as to be born a Platonist, Jowett will introduce you to the great master through whom alone we can think in certain levels, and whose perpetual modernness startles and delights. Montaigne will teach moderation in all things, and to be "sealed of his tribe" is a special privilege. We have in the profession only a few great literary heroes of the first rank, the friendship and counsel of two of whom you cannot too earnestly seek. Sir Thomas Brown's "Religio Medici" should be your pocket companion, while from the "Breakfast Table Series" of Oliver Wendell Holmes you can glean a philosophy of life peculiarly suited to the needs of a physician. There are at least a dozen or more works which would be helpful in getting that wisdom in life which only comes to those who earnestly seek it.

A conscientious pursuit of Plato's ideal perfection may teach you the three great lessons of life. You may learn to consume your own smoke. The atmosphere of life is darkened by the murmurings and whimperings of men and women over the non-essentials, the trifles, that are inevitably incident to the hurly-burly of the day's routine. Things cannot always go your way. Learn to accept in silence the minor aggravations, cultivate the gift of taciturnity and consume your own smoke with an extra draught of hard work, so that those about you may not be annoyed with the dust and soot of your complaints. More than any other the practitioner of medicine may illustrate the second great lesson, that we are here not to get all we can out of life for ourselves, but to try to make the lives of others happier. This is the essence of the oft-repeated admonition of Christ, "He that findeth his life shall lose it, and he that loseth his life for my sake shall find it," on which hard saying if the children of this generation would lay hold, there would be less misery and discontent in the world. It is not possible for anyone to have better opportunities to live this lesson than you will enjoy. The practice of medicine is an art, not a trade, a calling, not a business, a calling in which your heart will be exercised equally with your head. Often the best part of your work will have nothing to do with potions and powders, but with the exercise of an influence of the strong upon the weak, of the righteous upon the wicked, the wise upon the foolish. To you as the trusted family counsellor the father will come with his anxieties, the mother with her hidden griefs, the daughter with her trials, and the son with his follies. Fully one-third of the work you do will be entered in other books than yours. Courage and cheerfulness will not only carry you over the rough places of life, but will enable you to bring comfort and help to the weak-hearted, and will console you in the sad hours when, like Uncle Toby, you have "to whistle that you may not weep."

And the third great lesson you may learn is the hardest of all—that the law of the higher life is only fulfilled by love or charity. Many a physician whose daily work is a daily round of beneficence will say hard things and will think hard thoughts of a colleague. No sin will so easily beset you as uncharitableness towards your brother practitioner. So strong is the personal element in the practice of medicine, and so many are the wagging tongues in every parish, that evil speaking, lying and slandering find a shining mark in the lapses and mistakes which are inevitable in our work. There is no reason for discord and disagreement, and the only way to avoid trouble is to have two plain rules. From the day you begin practice never under any circumstances listen to a tale told to the detriment of a brother practitoner. And when any dispute or trouble does arise, go frankly, ere sunset, and talk the matter over, in which way you may gain a brother and a friend. Very easy to carry out, you may think! Far from it; there is no harder battle to fight. Theoretically, there seems to be no difficulty, but when the concrete wound is rankling, and after Mrs. Jones has rubbed in the cayenne pepper by declaring that Dr. J. told her in confidence of your shocking bungling, your attitude of mind is that you would rather see him in purgatory than make advances towards reconciliation. Wait until the day of your trial comes and then remember my words.

And in closing may I say a few words to the younger practitioners in the audience whose activities will wax, not wane, with the growing years of the century which opens so auspiciously for this school, for this city, for this country. You enter a noble heritage, made by no efforts of your own, but by generations of men who have unselfishly sought to do the best they could for suffering mankind. Much has been done, much remains to do; a way has been opened, and to the possibilities in the scientific development of medicine there seems to be no limit. Except in its application, as general practitioners, you will not have much to do with this. Yours is a higher and a more sacred duty. Think not to light a light to shine before men that they may see your good works; contrariwise, you belong to the great army of quiet workers, physicians and priests, sisters and nurses, all over the world, the members of which strive not neither do they cry, nor are their voices heard in the streets, but to them is given the ministry of consolation in sorrow, need and sickness. Like the ideal wife of whom Plutarch speaks, the best doctor is often the one of whom the public hears least; but nowadays in the fierce light that beats upon the hearth, it is increasingly difficult to live the secluded life in which our best work is done. To you the silent workers of the ranks, in villages and country districts, in the slums of our great cities, in the mining camps and factory towns, in the homes of the rich and in the hovels of the poor—to you is given the harder task of illustrating in your lives the old Hippocratic standards of learning, of sagacity, of humanity and of probity. Of learning, that you may apply in your practice the best that is known in our art, and that with the increase in that priceless endowment of sagacity, so that to all everywhere skilled succor may come in the hour of urgent need. Of a humanity that will show in your daily life tenderness and consideration to the weak, infinite pity to the suffering and a broad charity to all. Of a probity that will make you under all circumtances true to yourselves, true to your high calling, and true to your fellowmen.

TUBERCULOSIS OF THE URINARY SYSTEM IN WOMEN. REPORT OF THIRTY-FIVE CASES.[1]

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This paper will deal chiefly with diagnosis. I shall speak briefly of the treatment and the final results, time forbidding a technical review of the operations. There will be no attempt to present a systematic and comprehensive treatise on the subject of tuberculosis of the urinary system—this you can find in the text-books and special monographs. I hope to present a few practical and helpful facts and conclusions that may be drawn from a study of 35 cases which have occurred in the service of Dr. Howard A. Kelly and his associates.

Excluding those cases which are only a portion of a general miliary tuberculosis and those cases arising as a primary genital tuberculosis in the male, tuberculosis of the urinary system seems to be more common in women than in men, the ratio in the reported operation cases being as 6 is to 4. Our cases were all in the female. The right kidney was operated on in 17 and the left in 18 instances. Both kidneys were probably tuberculous at the time of operation in 5 cases.

Age.—By reference to the histories it will be seen that the disease is one of young adults, 20 out of the 35 cases being thirty years old or younger. The average age at the time of treatment was thirty-two and one-half years.

Family History.—The family history is recorded for 28 of these patients. In 13 cases there was obtained a family history of tuberculosis; in one of these, however, the disease was not reported in the immediate family. To illustrate how inaccurate a history may be on this point, I have only to cite Case 31, whose original history, taken by a careful ward interne, reported the family history negative for tuberculosis. When her sister, Case 33, came to me with tuberculosis of the urinary system I inquired more closely into the family history and found that the father had had a chronic cough with expectoration for years, and that a brother had recently died from an unknown cause after having had attacks of pleurisy. This sister has signs of tuberculosis of the lungs.

Past History.—The patient's past history interests us from several viewpoints. First, as showing a possible manifestation of tuberculosis in other organs. Case 1 had a swollen left knee four years before admission and was still suffering from weakness in this joint. Case 2 had an "obscure abdominal inflammation" ten years before her kidney symptoms began. Case 8 had undergone an operation for tuberculous submaxillary glands about two years before her bladder symptoms appeared. Case 11 had "malaria" as a child, she married at twenty-five, and when forty years of age she spent two years at Asheville, N. C., recovering from cough and hemoptysis. Her kidney trouble began at forty-five. I will refer you to the histories for further facts of interest in this connection.

Second, the past history is interesting as showing diseases which may have left kidney lesions as a "locus minoris resistentiæ" for a later attack by the tubercle bacillus. Scarlet fever is recorded in 5 cases and in Cases 1 and 27 may have been definitely associated with the tuberculous trouble.

The past history may be interesting and instructive because of the possible errors in diagnosis. This portion of the history merges with the history of the present illness. The first patient I operated on, Case 31, had been treated at intervals during nine years for supposed malaria. She lived in Baltimore, and chills and fever were her most pronounced symptoms. Case 32 was suffering from tuberculosis of both kidneys, and six months prior to my removal of an immense pus kidney from the left side the right kidney had been suspended for supposed Dietl's crises. Other patients in this series had been treated for rheumatism, appendicitis, and la grippe. To show that carelessness may determine our failure to make a diagnosis in this most important disease, I will cite the last case in my series. I first saw the patient two years ago. She had discovered a movable tumor in the right abdomen and a neighbor told her she had a floating kidney and should have it operated upon. On examination she had very little tenderness and no symptoms whatever. I made a diagnosis of movable kidney and advised her that it would not be wise to interfere unless her kidney gave her definite trouble. Soon after this she noticed soreness in the right side and inability to wear a corset or tight band. Eight months ago bladder symptoms began, together with pain in the right back and groin. On seeing her for the second time about one month ago I made a probable diagnosis of renal tuberculosis from her history alone, and on palpation, cystoscopic and urinary examination confirmed the diagnosis. Had I been more alert and made a careful microscopic examination of the urine two years ago I doubt not that I would have found evidence of beginning inflammation.

Clinical History.—Points of great interest in the history of the present illness are the duration of the disease and the probable seat of origin in the urinary system. A reference to the histories shows the extremes of existence of the symptoms to be two months and seventeen years, with an average of four and one-half years. Case 1 illustrates the difficulty of determining the date of origin of the disease as well as its primary location in the urinary system. Since early childhood the patient had suffered with pain and weakness in the back and some incontinence. The incontinence was worse after an attack of scarlet fever at sixteen. She had been treated for bladder trouble at ten and had suffered definite persistent bladder symptoms for six years. For only one year had she suffered with definite kidney symptoms. One would expect after six years of bladder symptoms to find a badly diseased bladder, but in this case cystoscopic examination showed simply a few granulations around the left ureteral orifice, and since the removal of the left kidney and ureter there have been no bladder symptoms. The pathologist's report says there was no tuberculosis of the ureter. Must we not say then that the disease in this case was primarily and throughout a kidney affection dating since early childhood but with the first definite symptoms located in the bladder?

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[1] Read before the Medical and Chirurgical Faculty of Maryland, at Blue Mountain House, September, 1903.

Again, Case 6 had noticed thick, ropy urine for several years, but her first symptoms, pain on voiding, began but eighteen months before her admission to the hospital. The bladder irritation was such that on her admission she was voiding from twenty to forty times in the twenty-four hours. There had been no symptoms referred to the kidney region, but on cystoscopic examination the bladder disease was found confined to the region of the left ureteral orifice, and the kidney at operation was found in an advanced state of necrosis. Case 29 was suffering with most intense bladder symptoms and did not complain of backache, but on examination the left kidney was found to harbor a tuberculous pyonephrosis, while the right was the seat of a colon bacillus pyelitis.

While the symptoms first noted were in the bladder in seventeen out of thirty-four of the cases, a close scrutiny of the histories and comparison with the clinic and pathologic findings convinces me that in by far the great majority of cases, urinary tuberculosis in women originates in the kidney. With the widest margin in favor of primary bladder infection I have classed but five of the thirty-five cases under this heading.

In the past six years of hospital practice I have seen but two cases of undoubted tuberculosis of the bladder in which other portions of the urinary system were intact. One of these I think was a case of primary bladder tuberculosis and was reported by Dr. Kelly in the Johns Hopkins Hospital Bulletin, 1903, XIV, p. 96. The other was a case of tuberculosis primary in the genital system and extending through the bladder wall from without.

The physical condition of the patient interests us from three points of view. First, the general condition. This varied in the greatest extreme. Some of the patients presented a picture of health, with a high percentage of hemoglobin, mucous membranes of a rosy red, and general nourishment of the most excellent degree. Others, on the other hand, were brought in on stretchers looking as though their chances for leaving the hospital alive were of the lowest grade. The factors contributing toward these varied states of health form an interesting study. Some of the patients came from poor homes characterized by bad hygienic conditions, and had been subject to hard work up to the time of going to bed. Others who came to us in equally bad condition had had all the advantages of medical science, climatic changes, and good nursing that money could command. I believe the two chief factors contributing to a desperate condition in these patients to be, first, a diseased kidney which is not draining freely, and second, irritation of the bladder disturbing the patient's rest at night. One may find a tremendous pus kidney in an apparently healthy patient providing the drainage is uninterrupted; whereas those patients suffering from repeated blocking of the ureter with attendant attacks of pain, chills and fever, almost invariably show a marked grade of cachexia.

Second, the physical examination is interesting as relating to the question of tuberculosis elsewhere. A reference to the histories show that Case 1 was probably afflicted with tuberculosis of the left knee, while Cases 5 and 8 had glandular tuberculosis. Five cases, numbers 11, 13, 20, 28 and 33, had evidence of lung involvement. Case 22 had been operated upon in Jena for double salpingitis, probably of tuberculous origin.

Third, the local condition in most of these patients received the most careful study, including cystoscopic examinations and the separation and examination of the urine from either kidney.

Diagnosis.—While the ability to do cystoscopic work is of the greatest help in the diagnosis and treatment of this disease, inability to use the cystoscope does not excuse the physician from making the diagnosis. A careful history alone generally points strongly to the true condition. Pain in the back, side, or inguinal region, together with a disturbance of the bladder function leads one to suspect some kidney disease. With a careful history one combines a physical examination. The kidney is usually palpable and tender. Palpation over the course of the ureter as it crosses the brim of the pelvis elicits tenderness and a desire to void urine, and the thickened ureter is often felt in this region. Through the vagina the thickened bladder, or the tender ureterovesical region is palpated, and the thickened ureter can nearly always be felt beginning at its vesical junction just anterior to the cervix and coursing outward and backward to disappear beneath the uterine vessels. By the rectal route is can be followed well out to the lateral pelvic wall.

These local changes are found in other forms of inflammation, but tuberculosis being by far the most frequent cause of inflammation of the entire urinary tract, you are now justified in warning your patient against possible contamination of her surroundings by the urinary excretions. The finding of signs of tuberculosis in other organs makes your diagnosis more certain. You may now place your patient in bed and after charting the temperature for a week, if there is no great disturbance of the temperature, a tuberculin test may be made. You have done all this without the use of the cystoscope and still have left the only means by which anyone, with or without the cystoscope, can make a positive diagnosis, viz., the examination of the urine. I hold that tubercle bacilli should be found in practically every case of kidney tuberculosis. Do not, as some have recommended, stain and examine twenty or thirty slides in one day. Examine one or two slides each day and in the course of a week there is likely to be a shower of bacilli from some freshly broken down focus of disease in the kidney. It must not be forgotten that the urine may at times be perfectly clear, particularly when the patient is most ill with pain, chills, and fever; or, in other words, when the ureter of the diseased side is blocked. The differential stain to exclude the smegma bacillus should be used as a routine practice in urinary work. If tubercle bacilli are not found on the stained slide, the fresh urine may be centrifugalized and a small quantity injected into a guinea-pig's peritoneal cavity. If but one supply of the suspected urine is available it is well to inject several guinea-pigs, some abdominally and some subcutaneously, because the guinea-pig is liable to succumb to the colon bacillus so often present in tuberculous urine. If you have facilities for making a culture from the bladder a sterile plate from a case with pyuria is very suggestive of tuberculous infection. From the histories you will see that tubercle bacilli were found in 15 out of 22 cases in which a note is made of the search, and in Case 13, where they were not found microscopically in the urine, the guinea-pig inoculated with urine catheterized from the left side developed a miliary tuberculosis.

I maintain that you should be able to make a diagnosis without the use of the cystoscope. But it is only those of you who use this instrument who can appreciate its value in accurately determining the condition of the kidneys, ureters and bladder, and in deciding what should be done and in what order.

Cystoscopy: Its Abuses.—Instead of specifying in this paper the many uses we make of the cystoscope, I wish to warn you against what I consider its abuses.

In the cystoscopic literature of the day we see that men all over the world are repeatedly catheterizing supposedly healthy kidneys through bladders known to be infected. You will see by reference to the table that this was done in a number of our cases. I have seen no immediate ill results from this practice, but a reference to Case 2 will show that she was catheterized on both sides eight years ago. At that time she had no evidence of bladder tuberculosis, and the ureter, thoroughly removed from the affected right side, was not tuberculous. The urine gathered from the left side was normal. She now has symptoms strongly pointing to involvement of her only kidney, and if this be diseased I think it fair to question whether the infection was not carried up by the catheter.

I hope to see the practice given up in our clinics. We know that bacilli must be carried into the ureter and kidney and we know that the passage of a catheter frequently causes enough trauma to elicit blood. Given a traumatic injury and the presence of bacteria and I am sure it is a combination that none of us would unnecessarily risk in the only healthy kidney we might possess. I am aware of the fact that a bacteriuria usually passes off without treatment and leaves no ill effect, but until we more thoroughly understand the relations governing infections and inflammations of the urinary tract I think we should be careful not to cross the portal from an infected bladder to a non-infected ureter and kidney. Indeed, I am beginning to question the advisability of examining a cachectic tuberculous patient in the knee-chest posture, for in the weak individual the ureterovesical orifice is liable to gape wide open on the sound side when the patient is placed in the knee-chest posture. While I have not tested the point in many cases I have not seen this occur in treating patients in the dorsal elevated pelvic position. Because of the same danger of overcoming the ureterovesical protection, I would condemn general curettage of an ulcerated bladder. A recent case at the Johns Hopkins Hospital had an acute colon bacillus nephritis after curettage of the infected bladder.

Catheterization of the supposedly healthy side is not necessary. Enough urine for a microscopic and chemic test can be gathered from the healthy side by simply holding the speculum under the ureteral orifice for a few minutes. Or the diseased side may be catheterized, the bladder thoroughly washed out, and what is collected in the bladder while the diseased side drains through the catheter, will represent the better side. One becomes accustomed to making due allowance for the few pus and epithelial cells that may have been left in the bladder after the washing, or that may come from the bladder ulcers during manipulation.

Treatment and Results.—In all of these cases the treatment was surgical. In Cases 7 and 8 the disease had been recognized by eminent medical experts, who advised the methods of treatment usually employed for tuberculosis of the lungs, but in each case the patient returned for operation in much worse condition than when first seen. Case 23 had been considered by medical and surgical men of high standing to be a case of tuberculosis of both kidneys and was sent to her home in Vermont to die as comfortably as possible. After a careful examination, Dr. Kelly concluded that her trouble was confined to the left side, and hers is a typical example of the treatment in an extreme case. Patience on the part of the physician and the patient is a cardinal requisite in many of these cases. The general health must be medically and hygienically supported and improved and this treatment must be supplemented by the necessary surgery. Case 23 entered the hospital in May, 1901. She came on a stretcher and was a most hopeless looking patient. She left the hospital June 2, 1903, with a fair prospect of good health. On May 3, 1901, the day following her admission, a vesicovaginal fistula was made under nitrous oxide gas anesthesia. On May 18, under the same anesthetic, a left nephrotomy was done, about 500 ccm. of pus being evacuated. One month later a left nephrectomy with partial ureterectomy was performed. She was then sent to her home under the care of a special nurse and in three months gained in weight from 95 to 135 pounds. On October 9, 1901, her vesicovaginal fistula was closed and after going home she added 17 more pounds in weight in two months. Her bladder symptoms becoming severe, she returned in January, 1902, for local treatment. After spending the summer at home she returned in October, 1902, when a portion of the pelvic ureter was removed through the vagina. But this did not help the painful bladder symptoms, and on April 1, 1903, Dr. Kelly excised the left half of the bladder. On dismissal in June the bladder held 4 ounces without discomfort, and her only symptoms were occasional neuralgic pains in the left crural nerves and neuralgic attacks about the face. I examined her bladder, and except for redness about the site of operation it was normal. If any of the tuberculous disease was left she will in all probability have to return for its removal after the bladder has been further dilated by forced retention of urine, which she is now practicing.

I am very skeptical about the topical treatment of bladder tuberculosis. I have yet to see a case recover without the use of the knife. Caspar[2] reports the cure of two cases and improvement of fourteen out of twenty cases treated by the use of small bi-weekly instillations of mercuric bichlorid in strength of 1:10000 to 1:1000, and he states that this is the only medicinal treatment he has found at all useful. Since reading his paper six months ago I have had enough experience with this method to encourage the belief that it may be helpful in some of these cases.

Case 1 of my series is the first on record of a complete nephroureterectomy. This, as all of the early cases, was done through what one patient in her letter describes as "an 18-inch incision," that is, the incision was carried from the 12th rib behind to the symphysis in front, almost "quartering" the patient.

In Case 10 Dr. Kelly first did a nephroureterectomy through the two short incisions which we use at present, one in the lumbar and one in the inguinal region.

Dr. Cullen, following the suggestion of one of the German writers, first resected the 12th rib on Case 26.[3] I have followed this method in each of my five cases and have found it greatly simplifies the exposure and control of the vessels.

So far as I know, I am the only operator who has removed the ureter and a section of the bladder wall through the extraperitoneal inguinal incision by simply displacing the uterine vessels forward. This was done in Cases 31 and 32. Dr. Kelly had removed a section of the bladder with the ureter in Case 16, but to do this had tied and cut the uterine vessels of the corresponding side. On Case 22 I removed, by vaginal incision, a portion of the bladder musculature with the lower end of the ureter after Dr. Kelly had removed the kidney and the upper end of the ureter through the usual lumbar and inguinal incisions. The uterine vessels were not interfered with in this case.

Simple nephrotomy was done on 3 patients. Case 4 died within eleven weeks and Case 5 died within two years. Both patients had evident involvement of the opposite kidney. Case 14, upon whom Dr. Stokes did nephrotomy, improved rapidly while in the hospital six weeks and then insisted on returning home. This is the only patient in the series we have utterly lost sight of.

Nephrectomy was done on 9 patients (6, 13, 15, 17, 18, 20, 21, 28, 33). Case 21 died six weeks after operation with evident involvement of the opposite kidney. The remaining eight patients are living and the wounds have healed in all but three, Cases 17, 28 and 33. Each of these patients has tuberculosis elsewhere in the system and it is probable that their ureters were tuberculous.

Nephrectomy and *partial ureterectomy* were done in 7 cases (7, 8, 9, 11, 19, 23, 24). They are all living and the wounds have all closed, except in Case 24, whose wound is still granulating after sixteen months. Five of these ureters were examined microscopically, four of them showing tuberculosis and one chronic ureteritis.

Nephroureterectomy was done on 13 cases (1, 2, 3, 10, 12, 22, 25, 27, 29, 30, 34, 35). These patients are all living, and their wounds healed promptly except in Case 25, whose wound is still slightly granulating after eight months. Microscopic examination showed nine of these ureters to be tuberculous and four to have chronic inflammation.

Nephroureterocystectomy was done in three cases (16, 31, 32). Case 16 died on the fifteenth day, evidently from a peritonitis due to rupture of the bladder on the previous day. Case 32 died on the sixth day, having been in an apparent uremic stupor since the operation. Her death was probably hastened by leakage and peritonitis, for the inguinal drainage was started on the fourth day and the quantity of urine collected through the retention catheter became markedly less immediately after the withdrawal of the drain. In Case 16 the ureter and section of bladder were removed through a median suprapubic transperitoneal incision. In Case 32 the usual inguinal incision was used but the ureter was so adherent to the peritoneum that this structure was opened during the operation throughout its pelvic portion.

From the good results I have seen after nephroureterectomy I do not think that removal of a portion of the bladder is often indicated at the primary operation. If the bladder ulceration is extreme the operation is prolonged, and if the peritoneal cavity is opened the post-operative danger is greatly heightened. In many cases the bladder inflammation is not specific and clears up after removal of the source of purulent urine. If the bladder ulceration be tuberculous it may be removed later through an extraperitoneal or peritoneal incision in either the suprapubic or inguinal region, or by vaginal incision.

The question of leaving the ureter is important from the standpoint of wound-healing. Of the nine nephrectomy cases, one, Case 21, died. The physician of Case 6 reports her in good health but does not state how soon her wound healed. Case 13 was closed at operation and healed by primary union. Cases 15 and 18 healed at once, before they left the hospital. Case 20 healed after six months. Case 17 is still open after three years, the rib having become infected. Case 33 is still open after one year, and Case 28 is open after eight months, a piece of gauze having been discharged from the wound after five months.

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[2] Monatschrift für Urologie, 1900, Vol. V, p. 499.

[3] Johns Hopkins Bulletin, XIII, p. 149, Exhibition of Cases.

Of special interest are the cases of nephrectomy and partial ureterectomy, because of the opportunity for examining the ureter microscopically. Of the seven specimens, two were not examined, four were tuberculous, and one showed a chronic ureteritis. Of the cases showing tuberculous ureteritis, Case 19 healed at once before leaving the sanitarium, Cases 8 and 23 closed after two years and Case 24 is still open after 16 months. Case 9, with chronic ureteritis, healed in 4 weeks.

Of the thirteen nephroureterectomies, nine ureters showed tuberculosis and four showed chronic ureteritis. Of the chronic ureteritis cases, Cases 1 and 26 closed rapidly, while Case 12 granulated for six months and Case 2 for five years. All of the tuberculous ureter cases closed soon except Case 25, whose wound is still granulating slightly after eight months. The slow healing in cases 2 and 12 can be explained only on the supposition of wound infection from the kidney during the operation.

Of the three cases of nephroureterocystectomy, Cases 16 and 32 died and the wounds in Case 31 healed promptly. Of the 23 cases in which the whole or a part of the ureter was removed the ureter was examined microscopically in 22, and of these 17 were tuberculous while 5 showed chronic inflammation.

From the above analysis it would seem, first, that tuberculosis of the ureter exists in a large proportion of cases of tuberculosis of the kidney; second, that a wound may close rapidly after the partial removal of a tuberculous ureter or it may suppurate for years after the complete removal of a non-tuberculous ureter; but that, in general, the partial removal of a tuberculous ureter is followed by months or years of suppuration, while the complete removal results in rapid closure of the wound.

A General Summary of Results.—One patient (Case 14) has not been heard from since leaving the hospital. Five patients, or 14 per cent, have died, two (Cases 16 and 32) from the results of the operation. Cases 4, 5, 21 and 32 had involvement of the other side. Two patients now living (Cases 2 and 3) may have tuberculous infection of the remaining kidney. Thirteen patients (Cases 3, 9, 10, 12, 18, 23, 24, 25, 27, 28, 33, 34, 35) still have bladder symptoms or are known to have a bladder lesion. Eleven of these, however, are in good health, many of them reporting better health than they have known for years. Two patients (Cases 29 and 30) on recent dismissal had colon bacillus infection of the remaining kidney, but they had very little pus in the urine, no symptoms, and considered themselves well. Nine patients (Cases 1, 6, 8, 13, 19, 20, 22, 26, 31) are reported or known to be in perfect health. This gives us 22 out of the 35, or 63 per cent, to be placed in the good-health class. The family physician of Case 7 writes that she is in fair health and shows no evidence of tuberculosis. Cases 11 and 15 are in poor health with symptoms of nephritis. Cases 17 and 33 have lung tuberculosis, but the disease is quiescent and the patients are apparently in good health.

Thirty-five is a comparatively small number of patients from which to draw dogmatic conclusions, but in view of the careful manner in which the above series has been followed, I feel justified in presenting a practical summary, as follows:

1. Urinary tuberculosis in women is a disease of early adult life.
2. It is usually primary in the kidney, although about half of the patients complain first of bladder symptoms.
3. It is confined to one side in the vast majority of cases. If involving both sides a very painstaking examination must be made of the separate urines to determine whether the treatment should be surgical or medical.
4. The disease should be kept in mind in dealing with any symptoms referable to the urinary tract; even such common occurrences as a supposed movable kidney or incontinence of urine should be carefully investigated.
5. Appendicitis and gall-stone colic must be differentiated. Any obscure or atypical case of supposed malaria or typhoid fever should remind one of this disease.
6. The disease is compatible with a long life of comparative health, and macroscopical and microscopical examination of our specimens shows that in some cases there is a tendency to spontaneous healing; but in spite of these two facts a careful study of these 35 cases shows the disease to be pre-eminently surgical.

SUMMARY OF CASES.

CASE 1.—E. L. P., aged 23, admitted to the Johns Hopkins Hospital December 5, 1895. Family history negative for tuberculosis. The patient was never strong. She had scarlet fever at 16, and 4 years ago la grippe and a swollen left knee. The left knee is still weak. She has had pain and weakness in the back and incontinence of urine since childhood. Since 10 years of age she has had bladder treatment, and for the past 6 years has had intermittent pain in the bladder. One year ago she suffered the first acute attack of pain in the left side and has had attacks every week since.

Examination.—The left kidney is not palpable; the left ureter is enlarged and tender as felt over the pelvic brim and through the vagina. Cystoscopy shows the left ureteral orifice granular and red. Urine: amber, 1018, acid, much albumen, many pus cells and casts, no tubercle bacilli found on searching once. The right kidney was catheterized and yielded normal urine.

Operation.—Kelly, extraperitoneal left nephroureterectomy, one long incision from ribs behind to symphysis in front.

Pathology.—Tuberculous pyonephrosis, chronic ureteritis.

Result.—Letter, April 15, 1903. Perfectly well, married 4 years, two children. Wound healed "as soon as an 18-inch incision could be expected to"

CASE 2.—K. W., aged 30, admitted to the Johns Hopkins Hospital December 7, 1895. Mother died of tuberculosis. The patient was delicate as a child. At 18, she was ill for 7 weeks with an obscure abdominal inflammation. Two years ago she suffered with an attack of sudden violent pain over the region of the right kidney, together with nausea, vomiting, chills and fever, and with frequent and burning micturition. Similar attacks have recurred about every 3 weeks since.

Examination.—The patient weighs 225 pounds. The right ureter is felt through the vagina as a cord one centimeter in diameter and very tender. The bladder is normal except for redness about the right ureteral orifice. The urine contains blood and pus, and on one examination no tubercle bacilli are found. Normal urine is catheterized from the left side.

Operation.—Kelly, right nephroureterectomy through lumbar and vaginal incisions.

Pathology.—Tuberculosis of right kidney, chronic ureteritis.

Result.—Letter, April 15, 1903. Now suffering with similar symptoms on the left side. Wound healed 5 years after operation.

CASE 3.—C. R., aged 26, admitted to the Johns Hopkins Hospital October 9, 1889. Her family history was not taken. Eleven years ago she began to suffer with frequent and painful micturition and incontinence, all these symptoms being aggravated at the menstrual period. One year later pain began in the left side and her tubes and ovaries were removed. On admission she was very anemic and weighed but 90 pounds. The bladder condition caused almost constant agony and the patient could rest but little. On *examination* the bladder and both ureters were thick and tender. Tubercle bacilli were repeatedly found in the urine catheterized from the left side. The urine catheterized from the right kidney was normal.

Operation.—Kelly, from 1889 to 1893 four visits to the hospital. Repeated anesthesias and catheterization of the ureters for dilatation. Vesicovaginal fistula. Ureterovaginal fistula. Left nephroureterectomy transperitoneal and vaginal.

Pathology.—Tuberculosis of left kidney and ureter.

Result.—Letter, November 5, 1895. Still some bladder symptoms but enthusiastic over good health. Wound healed at once. Letter, April 15, 1903. In wretched health, symptoms indicate involvement of the right side.

CASE 4.—M. B., aged 25, admitted to the Johns Hopkins Hospital May 11, 1896. Family history negative for tuberculosis. Patient delicate as a child. In January, 1895, she had an attack of diphtheria and since then has had frequent, burning and painful micturition. Four months ago pain in the left kidney and ureter. For the past 3 months a daily, afternoon chill followed by fever. She shows extreme emaciation. There is general ulcerative cystitis. The left kidney is twice the normal size, and both ureters are thickened. The urine loaded with pus. The temperature, hectic in type, varying from 97° to 104.2° F.

Operation.—Kelly, left nephrotomy, 250 cc. foul smelling pus. A section of kidney taken for examination shows tuberculosis.

Result.—The temperature after operation retained a hectic type. The patient grew worse and died 11 weeks after operation.

CASE 5.—M. H., aged 48, admitted to the Johns Hopkins Hospital February 18, 1897. No positive family history of tuberculosis. Patient had scarlet fever at 6, but has otherwise been strong and well. She has enlarged axillary glands. Two years ago she began to have pain in the left back and a weak "sickening" feeling, and after 6 months pain in the bladder and frequency of micturition. The patient has lost weight and strength and is very anemic. The left kidney is enlarged and the left ureteral orifice is red and puffy, and pus is seen oozing from it.

Operation.—Kelly, left nephrotomy, 350 cc. pus. The renal cortex only 5 mm. in thickness.

Pathology.—Renal tuberculosis.

Result.—Marked pyuria persisted even after the lumbar drainage, and the temperature ranged between 98° and 101° F. A suppurating axillary gland was opened one month after the kidney operation. The patient gained in weight and strength and was comparatively well for some time after going home, but died two years later.

CASE 6.—R. J., aged 22, admitted to the Johns Hopkins Hospital March 5, 1897. Family history negative for tuberculosis.

The patient noticed thick, ropy urine 3 years ago, and 18 months ago pain began with micturition. The pain and frequency have increased since. She is fairly well nourished. The appetite is poor and she has lost much weight and strength. The right kidney is enlarged. The right half of the bladder and the right ureter feel thickened and are tender. Bladder is normal except for an ulcerated area about the right ureteral orifice.

Operation.—Kelly, April 10, 1897, right nephrotomy. Cullen, September 8, 1897, intracapsular nephrectomy.

Pathology.—Renal tuberculosis.

Result.—Discharged November 17, 1897, in good health with haemoglobin 97 per cent. Her physician reports that she is now married and in good health.

CASE 7.—C. M. C., aged 25, admitted to a private hospital, March 11, 1897. Grandfather and mother died of tuberculosis. Patient had fair health until 3 years ago when she was taken with a sudden cramp-like pain beneath the ribs on the right side. She had two similar attacks the same year and four attacks the following year. Now has almost continuous severe pain. She has had no bladder symptoms. After a consultation in March 1897, she was sent to the mountains and placed on medicinal treatment, but her health became so bad that she returned for operation in October, 1897. She was then bed-ridden and was suffering severe pain in the right side, and had a daily rise of temperature.

The right kidney was enlarged and tender, and the tender right ureter could be easily palpated through the vagina. The bladder was normal except for a reddened right ureteral orifice. Many tubercle bacilli had been found by Minneapolis and New York physicians and they were easily found after her admission. The left kidney was catheterized and the urine found normal.

Operation.—Kelly, right nephrectomy and partial ureterectomy to pelvic brim.

Pathology.—Renal tuberculosis ureter not examined.

Result.—Lumbar sinus healed after several months. In June, 1902, was operated on for pelvic tuberculosis. Letter from physician in June, 1903. "Is now in fair health, no evidence of active tuberculosis."

CASE 8.—M. W., aged 23, admitted to a private hospital, May 7, 1897. Family history not taken. Always good health until 3 years ago, when the right submaxillary glands were removed for tuberculosis. The urinary symptoms began 11 months ago with frequent micturition and a sense of discomfort on holding the urine. For 6 months she has suffered attacks of sharp pain in the right kidney region. After consultation the patient was sent home for medical and climatic treatment, and she improved for 6 months. She was then taken with increased pain, chills and fever, and returned in April, 1898, in far worse health than at first admission. On examination there was no tenderness over kidney or ureters. The right ureteral orifice was red and swollen and many tubercle bacilli were found in the urine from the right kidney.

Operation.—Kelly, right nephrectomy and partial ureterectomy.

Pathology.—Renal and ureteral tuberculosis.

Result.—Third admission November, 1898, with granulating lumbar sinus which was curetted. Had gained 30 pounds since operation. Physician wrote in May, 1903, "patient in excellent health when last seen in August, 1902, the wound entirely healed."

Case 9.—M. R., aged 33, admitted to the Johns Hopkins Hospital April 16, 1898. Family history negative for tuberculosis. Always strong and well until the urinary trouble which began 4 years ago as a frequency of urination. About the same time a dull aching pain began in the right back, and for the past 6 months this has been increasing. Her general health seems fairly good. Her right kidney can be displaced below the costal border and seems of normal size. The right ureteral orifice is red and puffy, and the mixed urine has considerable pus.

Operation.—Kelly, right nephrectomy and partial ureterectomy.

Pathology.—Renal tuberculosis. Chronic ureteritis. Two small calculi in the kidney.

Result.—Letter from physician, June, 1903. The patient still has frequency of urination and she now has some discomfort on the left side. No enlargement or tenderness can be detected in the left kidney or ureter. "The patient is in better health than I have ever known her."

Case 10.—C. W., aged 26, admitted to the Johns Hopkins Hospital May 3, 1898. One brother had tuberculosis. The patient had the usual diseases of childhood, except scarlet fever. About 10 years ago for a period of 5 or 6 months she had sharp intermittent pains in the left lumbar region, but does not recall urinary disturbance at that time. She dates her present illness from an attack of "typhoid fever" 5 years ago, since which time she has had some pain on urination. For 3 years there has been greater pain, and the frequency of voiding urine has increased. For 6 months there has been a dull aching pain in the left lumbar region. The patient on admission appeared to be in fair health. The bladder and left ureter were thickened and tender on palpation through the vagina. There was extensive ulceration over the posterior wall of the bladder. Many tubercule bacilli were found in the purulent and bloody urine.

Operation.—Kelly, left nephroureterectomy. Curettage of bladder. This was the first patient in whom the kidney and ureter were removed through the separate lumbar and inguinal incisions.

Result.—Patient examined in June, 1903. Her general health better than for years. Still some pain and frequency of urination, and the posterior bladder wall shows about the same degree of ulceration.

Case 11.—S. E. C., aged 49, admitted to the Johns Hopkins Hospital December 30, 1898. Family history: Grandfather, father and one brother died of tuberculosis. One brother and one sister have weak lungs. The patient has never been strong. She had "malaria" as a child and pneumonia at 25. Eight years ago was at Asheville, N. C., recovering from haemoptysis and cough.

For four years has had pain and tenderness in the right side, occipital headaches, swelling of eyes and hands, palpitation of heart, and frequent urination.

The patient has moderately good color and appears fairly well nourished. There are signs of old lesions in the apex of the right lung. The urine contains a large quantity of albumen, many hyalin and granular casts and some pus.

Operation.—Kelly, right nephrectomy and partial ureterectomy. Exploratory coeliotomy to examine left kidney.

Pathology.—Renal tuberculosis. Ureter not examined.

Result.—Patient seen in May, 1903. Her health has been much improved by the operation and she was afterwards able to work very hard as principal of a city school for 3 years. She has now given up work because of nephritic symptoms and attacks like angina pectoris.

Case 12.—M. A., aged 40, admitted to the Johns Hopkins Hospital May 12, 1899. One sister died of tuberculosis. Mother died of paralysis. She had chronic bladder trouble. The patient had pneumonia at 10, followed by lung trouble. She was well until 28, when she had "catarrhal fever" with chills at onset.

Three and one-half years ago she was taken ill with sudden severe pain in the urethra, and within 48 hours a severe pain in the right lumbar region. Since then there have been many attacks of pain referred to the perineum with nausea, vomiting and severe shaking chills. Frequent urination has been an almost constant symptom. The patient is extremely emaciated. The right kidney is lobulated and very tender. The right ureter is palpable over the pelvic brim and through the vagina, and is very tender. Cystoscopy shows the bladder to be ulcerated over the right hemisphere.

Both kidneys were catheterized, normal urine being obtained from the left and a very purulent urine in which no tubercle bacilli were found from the right kidney.

Operation.—Kelly, right nephroureterectomy, two incisions, lumbar and inguinal, the ureter being cut off above the uterine vessels, both wounds closed. The inguinal wound suppurated and healed only after six months.

Pathology.—Renal tuberculosis, chronic ureteritis.

Result.—Letter, April, 1903. Symptoms of bladder trouble have persisted. Health has been better. Cough for past 3 months.

Case 13.—M. S., aged 33, admitted to a private hospital, April 26, 1898. Family and past history not taken. Patient had haemoptysis 10 years ago and has had a slight cough at times. Has recently been in the Adirondacks for lung tuberculosis and still has a few fine râles in both apices. Developed haematuria 2 months ago and guinea pigs inoculated with urine, developed tuberculosis.

General health very good. Still has haematuria. At times the temperature registers 100° F.

Both kidneys were catheterized and pyuria found only on the left side. Guinea pigs were inoculated with urine from both sides and the pig inoculated from the left side developed tuberculosis.

Operation.—Kelly, left nephrectomy, wound entirely closed.

Pathology.—Renal tuberculosis.

Result.—Physician reports in May, 1903, that the patient seems to be in perfect health.

Case 14.—L. F., aged 22, admitted to the Johns Hopkins Hospital September 5, 1898. Family and past history not taken. For 2 years the patient has had an indefinite pain in the left side and for the past 3 months there has been a constant dull pain and sense of fulness. Two weeks ago she noticed a swelling. No bladder symptoms.

The patient was extremely emaciated and on admission had a temperature of 101.7° F. An immense tumor mass filled the left flank.

Operation.—Stokes, left nephrotomy, large amount of greenish fetid pus.

Pathology.—Tissue scraped from sinus three weeks after operation showed tuberculosis.

Result.—Patient left hospital much improved, having gained in weight and strength. Not heard from since.

Case 15.—B. V., aged 25, admitted to the Johns Hopkins Hospital October 30, 1898. Family and personal history excellent. For 2 or 3 years the patient had suffered frequent attacks of pain in the right side and over the bladder region. During these attacks she had fever of a few days duration. She had been treated for uterine trouble, and one year previous to admission had had the appendix and left ovary removed without relief from her symptoms. Shortly before admission her family physician discovered tubercle bacilli in the urine. On admission she was 6 months pregnant, had a high temperature and was very emaciated and weak. On catheterization hydropyoureter was found on both sides, the right side yielding a very purulent urine.

Treatment.—Kelly, an abortion was induced and she was sent to the mountains for 3 weeks. A left nephrotomy was then done to determine the condition of her kidney. She was sent home for 6 weeks. Right nephrectomy.

Pathology.—Before operation many tubercle bacilli were found in the urine by using the differential stain. The right kidney was completely involved in a condition of sclerotic atrophy. Many sections were made from all parts of the kidney and no tubercles could be found.

Result.—The patient weighs 70 pounds more tnan at the time of her operation. She has had fair health alternating with attacks bordering on uremia. She suffers with severe pain in the left kidney region at times, but the urine is free from pus and casts, and from a former colon bacillus infection.

Case 16.—J. McH., aged 43, admitted to a private hospital, February 7, 1900. No family or personal history taken. The bladder was ulcerated about the left ureteral orifice. The left ureter was thickened. Pyuria, haematuria, marked albuminuria, culture negative, tubercle bacilli in a catheterized specimen.

Operation.—Kelly, left nephroureterocystectomy. Kidney removed through lumbar wound. Ureter and a portion of the bladder removed through a suprapubic median transperitoneal incision.

Pathology.—Tuberculosis of kidney, ureter and bladder.

Result.—Operation March 6, evident rupture of bladder March 20, death March 21.

Case 17.—L. C., aged 22, admitted to the Johns Hopkins Hospital July, 1899. Family history not taken. Nine years ago the patient had an attack of "typhoid pneumonia" and since then has been subject to attacks of pain in the left side. Has been supposed to have malaria at times for the past 5 years suffering from repeated attacks of chills and fever. For the past 4 or 5 months with increased pain in the side there has been increased frequency of micturition.

The patient is very anemic and weak, the temperature is hectic in type reaching 103.4° F. A large painful mass is in the region of the kidney. The bladder normal except for a red swollen left ureteral orifice. Pyuria and haematuria, no tubercle bacilli found in one examination.

Operation.—Russell, July 20, 1899, left nephrotomy. Miller, February 26, 1900, dilatation of sinus, many tubercle bacilli in pus of sinus. Kelly, March 16, 1900, intracapsular nephrectomy.

Pathology.—Renal tuberculosis.

Result.—The patient has been doing heavy servant's work since her operation. She was in the hospital in December, 1902, with pleurisy. Letter, April, 1903, at times has pain in the right lung. Wound still open (necrosing rib).

Case 18.—J. C. R., aged 29, admitted to a private hospital, March 7, 1900. No family history of tuberculosis. Scarlet fever at 7 with no sequelae. Five years ago began to have ardor urinae and in a few months severe pain in the uretha. Three years ago in bed 2 months with "inflammation of the kidney." Eighteen months ago the urethra was forcibly dilated and she has been having bladder irrigations since.

Examination of bladder shows diffuse ulceration. Bladder capacity is 22 ccm. Purulent urine catheterized from the left kidney.

Operation.—Kelly, April 6, 1900, suprapubic cystostomy, and left nephrotomy. November 22, 1900, intracapsular nephrectomy. Closure of suprapubic opening. January, 1901, and April, 1902, plastic operations over the sphincter urethrae.

Pathology.—Renal tuberculosis.

Result.—Is now under observation. General health good. Bladder is normal. Still some incontinence.

Case 19.—W. McC., aged 46, admitted to a private hospital, May 19, 1900. Family history negative for tuberculosis. Scarlet fever as a child, no other serious illness. For two years the patient has had frequency of micturition. Tubercle bacilli were found in the urine.

Operation.—Kelly, right nephrectomy, partial ureterectomy.

Pathology.—Tuberculosis of kidney and ureter.

Result.—Letter, June, 1903. In perfect health, gained in weight from 130 to 167 pounds. Wound healed before leaving hospital.

Case 20.—B. C. I., aged 30, admitted to the Johns Hopkins Hospital June 16, 1900. Family history negative for tuberculosis. The patient had the usual diseases of childhood but has otherwise been strong and healthy until the present illness which began 9 months ago with bladder symptoms. She had frequent and painful micturition and has lost much weight and strength. Three months ago she was treated for la grippe and malaria, and she has been in bed for the past four weeks with chills and fever. On admission the patient was extremely cachectic and it was a question whether she could bear a general anesthetic. Her temperature was 106.2° F. There was possible involvement of the left apex. In the right flank a large visible tumor extending quite to the crest of the ilium detected. The right ureter was thick and tender as palpated through the vagina. The bladder was normal except for an area of reddening and ulceration about the right ureteral orifice about 4 by 6 cm. in extent.

Operation.—Kelly, right nephrectomy.

Pathology.—Renal tuberculosis.

Result.—Letter, April 1903. Perfectly well since leaving hospital and doing heavy household work. Wound healed 6 months after leaving. At times after exposure to wet and cold there are slight bladder symptoms.

Case 21.—P. L., aged 30, admitted to the Johns Hopkins Hospital July 24, 1900. Two uncles had tuberculosis. One brother died with inflammation of the lungs. Since 16 years of age the patient has had 10 severe attacks of bronchitis. She has had none for the past 4 years. Three years and 8 months ago her bladder symptoms began as an increased frequency of urination and for 2 years there has been severe dysuria. The symptoms have been confined to the bladder. Three years ago she was said to have Bright's disease.

On admission the emaciation and weakness were extreme, the temperature was hectic ranging from 98° to 105° F. There was a large mass in the right flank.

Operation.—Kelly, right nephrectomy.

Pathology.—Renal tuberculosis.

Result.—One month after operation severe pain in the left kidney region, bloody stools, headache, nausea and vomiting, suppression of urine. Died 6 weeks after operation.

Case 22.—M. L., aged 33, admitted to the Johns Hopkins Hospital March 5, 1901. Father and mother died of "cancer of the stomach." One sister died of tuberculosis, and one brother of Pott's disease. The patient at 18 had "typhoid fever" followed immediately by a bad cough for 2 years, and she was said to have consumption. Profuse leucorrhea during these two years, 1886 and 1887. In 1897 she had a double salpingectomy performed for pyosalpinx. Ten months ago she had an attack of severe pain in the left side radiating to the groin and bladder. The attacks have recurred about every two weeks and recently they have been daily. There has been no disturbance of micturition except during the attacks when there has been a frequent passage of a small quantity of urine. With the attacks there has been nausea and a movement of the bowels followed by chilly feelings and fever.

The patient on admission was well nourished and of good color. Neither kidney was palpable and the bladder was normal except for a red ureteral orifice. The urine contained much pus and an inoculation of agar was negative. Many tubercle bacilli were found in the urine catheterized from the left side.

Operation.—Kelly, Hunner, left nephroureterocystectomy, three incisions, lumbar, inguinal, and vaginal. A small section of bladder wall removed with ureteral stump through the vagina.

Pathology.—Tuberculosis of kidney and ureter.

Result.—Patient seen May 1, 1903, perfectly well, no symptoms.

Case 23.—H. C. M., aged 32, admitted to the Johns Hopkins Hospital May 2, 1902. Family history negative for tuberculosis. She had scarlet fever as a child and throat trouble for years afterward. 17 years ago sudden sharp pain in bladder; in bed four days; frequent micturition. Since 1892 has been conscious of some bladder disturbance. In 1897 to 1898 had "seven-day chills" and in February, 1898, severe attack of pain in the left kidney. "Mild prolonged typhoid" in 1895. On admission patient was extremely emaciated; very large kidney, thickened, tender bladder and left ureter. Left half of bladder extensively ulcerated. Temperature at times 103°.

Operation.—Kelly, May 3, 1901, vesicovaginal fistula. May 18, 1901, nephrotomy; large abscess 500 cc. pus. June 15, 1901, left nephrectomy, partial ureterectomy. October 14, 1901, closure of vesicovaginal fistula. October 17, 1902, excision of portion ureter through the vagina. April 1, 1903, excision of left half of bladder.

Pathology.—Tuberculosis, kidney, ureter and bladder.

Result.—Still under observation. She has gained from 95 to 140 pounds but still has pain in the course of left crural nerve, left half of bladder scarred and red, no ulceration.

Case 24.—L. J., aged 57, admitted to the Johns Hopkins Hospital May 11, 1901. No family history of tuberculosis. Patient has always been well. Present illness began 9 years ago as a pressure feeling in vagina with frequent and painful micturition. She has had no symptoms in the region of the kidney. On admission patient is well nourished; neither kidney palpable; thickened, tender bladder and left ureter; bladder ulcerated over left half. Capacity 40 cm. Cultures sterile. Normal temperature. Tubercle bacilli found in urine.

Operation.—May 15, 1901, vesicovaginal fistula; irrigations and repeated curettage. February 1, 1902, nephrectomy, partial ureterectomy. May 26, 1902. Closure of vesicovaginal fistula.

Pathology.—Tuberculosis of kidney and ureter.

Result.—Is under observation. Good health, good appetite, sleeps well; at times is troubled with bladder symptoms; lumbar wound still open.

Case 25.—A. P., aged 28, admitted to the Johns Hopkins Hospital October 3, 1902. Mother has "asthma and heart trouble." One brother died of tuberculosis. Patient has always enjoyed good health. 15 months ago dull aching pain began in left side; attacks every two weeks. Four months later pain in bladder and frequency of urination. On admission, fairly well nourished, haemoglobin 70 per cent. Tenderness and muscle rigidity in the left kidney region, thickened tender left ureter felt through vagina. Almost universal ulceration of bladder. Temperature hectic; subnormal to 101.7°. Many tubercle bacilli in urine.

Operation.—Kelly, left nephroureterectomy, three incisions, lumbar, inguinal and vaginal.

Pathology.—Tuberculosis of kidney and ureter.

Result.—Letter, April 15, 1903. Still has bladder symptoms and haematuria. No backache. Lumbar wound is still granulating. "Except for bladder trouble I feel as well as I ever felt in my life."

Case 26.—Mrs. M., aged 47, admitted to a neighboring hospital 1902. (Johns Hopkins Bulletin, 1902, Vol. XIII, p. 149.)

Family and past history not taken. Her only symptoms were slight frequency of micturition and loss of weight. Is fairly well nourished. Cystoscopy shows slight reddening around left ureteral orifice. Both kidneys catheterized. Urine from left kidney showed many tubercle bacilli. Urine from right kidney some albumin.

Operation.—Cullen, left nephroureterectomy.

Pathology.—Tuberculosis of kidney, chronic ureteritis.

Result.—Patient now perfectly well.

Case 27.—H. R., aged 24, admitted to the Johns Hopkins Hospital November 5, 1902. Family history negative for tuberculosis. She had scarlet fever at 7, was dropsical for a time and never robust since. Two years and four months ago she began to have pain in right back and at the same time frequent and painful urination and tenesmus, with blood. She was first in hospital June 25, 1901, when a diagnosis was made of tuberculosis of the right kidney, ureter and bladder. She refused operation. Her health improved until recently. On admission her general condition was good. Her right kidney was easily palpated and very tender. Cystoscopy; bladder normal except right posterior wall, where about one-third of the entire organ is deeply inflamed. Temperature, normal.

Operation.—Cullen, right nephroureterectomy, lumbar and inguinal incisions. Drainage of both wounds with rapid healing.

Pathology.—Tuberculosis, kidney and ureter.

Result.—Letter, May 8, 1903, health improved. Rheumatic pains in knee, soreness in back, more on left side. Frequent micturition and discomfort if urine is held.

Case 28.—A. T., aged 34, admitted to the Johns Hopkins Hospital, November 14, 1902 (see American Gynæcology, 1902, Vol. I, p. 561). Two uncles died of tuberculosis. She was never ill and never robust. There was a suggestive history of lung trouble eight years ago, rheumatism 6 years ago. Stricture of ureter March 1902. Four years ago, during pregnancy, she began to have frequency of micturition. When her child was 3 months old, she had severe attacks of kidney colic. March, 1902, ureterovesical anastomosis by Dr. Hunner and in June, 1902, laparotomy for tuberculous peritonitis and intestinal obstruction. On admission in November her health was fairly good. Slight tubular modification at both apices. Hectic temperature. Cystoscopy, diffuse ulceration about ureterovesical anastomosis.

Operation.—Kelly, right nephrectomy.

Pathology.—Tuberculosis of kidney, tuberculous pyelitis.

Result.—Letter, April 20, 1903. Temperature normal, wound not healed, no backache, some bladder symptoms.

Case 29.—Miss P., aged 52, admitted to a private hospital, October 15, 1902. Family history negative for tuberculosis. For

13 months she has had pain and increased frequency of urination and recently marked haematuria. No pain in back. General condition on admission, poor. Haemoglobin, 48 per cent. Cystoscopy, bladder generally inflamed and deeply ulcerated about left ureteral orifice. Both ureters catheterized; left pyuria; colon bacillus infection and slight pyelitis on the right.

Operation.—Kelly, October 21, 1902, vesicovaginal fistula. November 11, 1902, suprapubic drainage. February 26, 1903, left nephroureterectomy. Ureter removed down to uterine vessels. April 7, 1903, closure of vesicovaginal fistula.

Pathology.—Tuberculosis of kidney and ureter.

Result.—Discharged, May 19, 1903. Bladder perfectly normal, no symptoms. Some pus and epithelial cells detected in urine, with colon bacillus infection. Is gaining in weight and strength.

Case 30.—F. S. S., aged 36, admitted to a private hospital, March 13, 1903. Family history negative for tuberculosis. Her past health has been good. Three and one-half years ago patient suffered acute attack of pain in bladder and ureters with burning micturition, the attacks lasting only one-half hour. Six months ago after an attack of pneumonia and septicaemia pain begain in her right side and has continued. General condition on admission fairly good. Haemoglobin 85 per cent. Right kidney palpable, small. Right ureter thickened. Right kidney catheterized, pyuria, no tubercle bacilli found.

Operation.—Kelly, right nephroureterectomy.

Pathology.—Tuberculosis of kidney and ureter.

Result.—About one week after operation was delirious for several days although urea percentage was higher than before operation. Discharged, April 23, 1903, in excellent condition, urine showing a trace of albumin and a few pus cells.

Case 31.—S. S., aged 29, admitted to the Johns Hopkins Hospital January 18, 1902. Father probably has tuberculosis. One brother died after lung trouble. One sister has tuberculosis of lungs, right kidney and bladder. For the past nine years patient has had pain in the right back, frequent and painful micturition and at times chills, fever and vomiting and has been treated for malaria. General condition shows marked cachexia. Enlarged right kidney, enlarged and tender right ureter.

Cystoscopy, shows ulcer about right ureteral orifice and independent ulcer in vertex of bladder. Temperature varies from normal to 100.2.° No tubercle bacili were found on two examinations. Fairly marked tuberculin reaction.

Operation.—Hunner, right nephroureterocystectomy, two incisions, lumbar and inguinal. Portion of bladder removed with ureter without disturbing uterine vessels. The vertex ulcer removed through suprapubic extraperitoneal incision

Pathology.—Tuberculosis, kidney and ureter, ulcerative cystitis.

Result.—Examined May 22, 1903, in perfect health, nursing a five-months-old baby. Bladder everywhere normal.

Case 32.—M. E., aged 30, admitted to a neighboring hospital, May 1, 1902. One sister probably has tuberculosis. Patient was delicate as a child; health good since 10 years of age. Three years ago had first attack of severe pain in right kidney with chills fever and vomiting. Similar pains in left side began nine months ago. Has had bladder symptoms for five months. Five months ago the right kidney was suspended for supposed Dietl's crises. On admission patient was very anaemic and weak. Both kidneys were palpable and tender. The left kidney was very large and left ureter greatly thickened. Patient suffered from frequent chills, fever and vomiting, the temperature frequently reaching 103° and 104°. The urine contained much pus and blood and tubercle bacilli were found in the urine catheterized from either side.

Operations.—Hunner, vesicovaginal fistula. Patient placed in tub on constant irrigation. After healing of bladder left nephroureterocystectomy and closure of vesicovaginal fistula.

Pathology.—Tuberculosis of kidney and ureter.

Result.—Uraemic symptoms, leakage of bladder wound fourth day, death sixth day.

Case 33.—D. H., aged 19, admitted to a neighboring hospital, July 7, 1902. Sister of S. S., case 31 above. Patient had severe bronchitis one year ago with purulent sputum and chills. The cough has persisted. The bladder trouble began one year ago with frequent micturition. Six months later, pain and stiff feeling in back and pain in right inguinal region and over bladder. On admission patient was well nourished, the right kidney and ureter enlarged and tender. The bladder showed almost general ulcerative cystitis. Many tubercle bacilli in urine.

Operations.—Hunner, July 8, 1902, vesicovaginal fistula. Placed in tub. Irrigations. July 31, right nephrectomy.

Pathology.—Tuberculosis of kidney.

Result.—Still under treatment for extensive ulceration of bladder. Lumbar sinus not healed.

Case 34.—A. L., aged 38, admitted to a neighboring hospital, March 16, 1903. Mother died of tuberculosis. The patient's health has been good. Bladder trouble began three years ago with increased frequency of urination. For the past three months there has been more or less incontinence and the patient has been very tender over the left side. At present there is absolutely no control of urine. General condition fairly good. Left kidney and ureter enlarged and tender. Left half of bladder inflamed and ulcerated. Many tubercle bacilli in urine catheterized from left kidney. The temperature is normal, except for slight elevation.

Operation.—Hunner, left nephroureterectomy.

Pathology.—Tuberculosis of kidney and ureter.

Result.—Discharged May 1, 1903. Bladder much less inflamed, holds 120 ccm. of urine without discomfort.

Case 35.—A. B., aged 30, admitted to a neighboring hospital, May 24, 1903. Family and past history negative. Two years ago she noticed a swelling on the right side. Seven months ago bladder symptoms began together with pain in the right back passing through to the groin. I examined the patient two years ago and made a diagnosis of movable right kidney. There were no symptoms at that time. Her general condition on admission was fair. The right kidney and ureter were enlarged and tender. The right third of the bladder was inflamed. and ulcerated and several white polypi were situated near the ureteral orifice. Many tubercle bacilli in the urine catheterized from the right kidney. The temperature showed slight elevation.

Operation.—Hunner, right nephroureterectomy, lumbar and inguinal incisions. Ureter excised down to uterine vessels. Rapid healing of both wounds.

Pathology.—Tuberculosis of kidney and ureter.

Result.—Discharged June 21, 1903. Bladder shows an area of inflammation 3 cm. in diameter about the right ureteral orifice. Holds 360 ccm. of urine without discomfort.

THE SECOND HOSPITAL IN THE COLONIES, THE "COOLE SPRINGS OF ST. MARIES," MARYLAND, 1698.[*]

By J. Hall Pleasants, M. D.

Maryland may claim the distinction of having been the first of the colonies to agitate the question of establishing a hospital within its boundaries, for as early as 1638 we find the well-known pioneer priest Andrew White urging upon Lord Baltimore the necessity of such an institution. Nothing was actually accomplished, however, until the close of the century, when, in 1698, a hospital was established at the "Coole Springs of St. Maries." During this interval the Dutch East India Company, in 1658, had built at New Amsterdam, an almshouse and hospital, known as the "Old Hospital," or "Five Houses," of which the present Bellevue claims to be a direct outgrowth.[1] The "Five Houses" is probably the oldest hospital in the colonies, the Cool Springs dating second in the order of establishment. The statement frequently made that the Pennsylvania Hospital, founded in 1751, is the oldest hospital in the colonies, is thus not borne out by facts.

We shall first refer briefly to the early suggestion to found a hospital in Maryland, and shall then trace the history of the Cool Springs.

In the recently recovered Calvert papers there is a letter from Father White to Lord Baltimore, dated from Maryland, Feb. 20, 1638.[2] This letter, written four years after the founding of the province, refers in no uncertain way to the sickness among the settlers. He is inclined to attribute much of this to the "eating of flesh and drinking salt waters and wine by advice of our Chirurgian rather (than) by any great malice of their feuers, for they who keep our diett and absteinence generally recovered." Father White's opinion of the surgeon is evidently not of the highest. He then goes on to add that such excesses "begett feuers troublesome enough where wee want physick, yet not dangerous at all if the people willbe ruled in their diett, which is hard for the vvlgar *unless wee had a hospitall here to care (for) them and keep them to rule perforce whch some worthy persons of this place doe think upon.*" There is nothing to show that Father White's suggestion was acted upon, or that a hospital of any kind was founded in Maryland until the establishment of the Cool Springs sixty years later.

In the "Coole Springs of St. Maries," Maryland may lay claim to more than a mere hospital, however, and its establishment in 1698 really marks the foundation of what was probably also the first sanatorium in the colonies. That this once famous resort should have fallen into oblivion and its very name be almost forgotten, is not surprising when we recall the history of old St. Mary's, and when we learn upon what a slight basis the popularity of these springs actually rested. The current histories of Maryland scarcely even refer to its existence. Yet at the close of the seventeenth century this same "Coole Springs" was the cause of much legislative discussion, and of even more religious ill-feeling The perusal of the Archives of the province gives us some idea of the important place which these "springs of healing waters" occupied in the minds of the early settlers.

In the winter of 1697-98 the southern counties were visited by a severe pestilence of some kind. Neither an examination of our own records nor those of the neighboring colonies throws any light whatever upon the nature of this pestilence. Smallpox naturally suggests itself to us, as its terrible ravages among the early colonists are only too well known. Yet it is scarcely probable that *convalescents* from this disease would seek spa treatment, for it will be seen that the "Springs" came into prominence during the *decline* of the epidemic. Whatever its character, the pestilence was especially prevalent and its ravages most severe in Charles County.

We first hear of "the pestilence" in connection with the religious ill-feeling aroused by the activity of the Roman Catholic priests among the sick. The following message, sent by the Lower House to Governor Nicholson, March 29, 1698,[3] calling his attention to the matter, gives us an idea of the intolerance of the times:

> May itt please yor Exncy
>
> "Vpon reading a certaine Letter from a Reverend Minister of the Church of Engld which yor Exncy was pleased to cōmunicate to us Complaining to yor Exncy how that the Popish Priests in Charles County do of theire own Accord in this violent & rageing Mortality in that County make itt theire business to goe up and (down) the County to psons houses when dying & frantick and endeavour to Seduce and make prosellites of them & in such Condition boldly presume to admnistr the Sacrement to them. Wee have put it to the Vote in the house, if a Law should be made to restrayne such theire prsumption or not and have concluded not to make such Law att prsent, but humbly to Intreat yor Excy that you would be pleased to Issue your proclamation to Restrayne and prohibite such theire Extravagante and prsumptious behaviour.
>
> Signed p Ordr W. Bladen, Clk: house Delegates."

This shows well the intense religious bigotry of the times, for it should be remembered that in matters of religion, Maryland was really among the most liberal of the colonies. For several years the Catholics numerically had formed only

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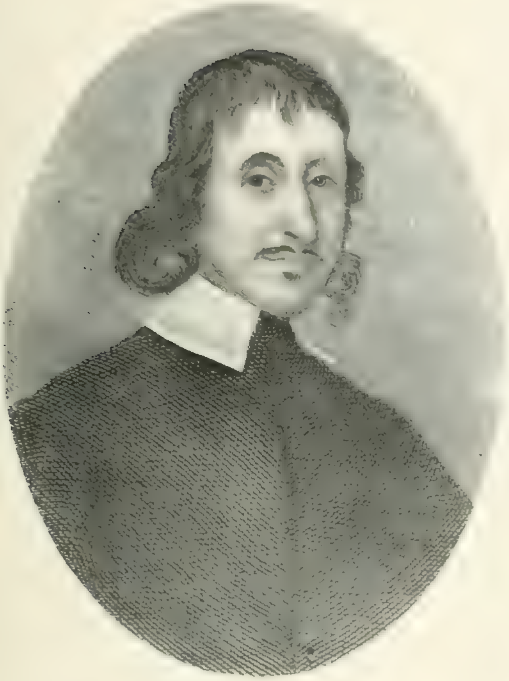
[*] Read before the Johns Hopkins Hospital Historical Club, October 19, 1903.

[1] R. J. Carlile: An Account of Bellevue Hospital, 1893, p. 1.

[2] Fund Publication of the Maryland Historical Society, No. 28, p. 202.

[3] Archives of Maryland, Vol. XXII, p. 22.



John Winthrop

(Substitute the above picture for that of John Winthrop on page 295 of the November, 1903, BULLETIN.)

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[4] Proceedings of the Council of Maryland, July 1, 1698. Md. Hist. Soc. MSS.

[5] Archives of Maryland, Vol. XXII, p. 61.

[6] Proceedings of the Council of Maryland, June 4, 1698. Md. Hist. Soc. MSS.

ing desk & some Benches made in the New house there for the readers to read prayers & the people to sit on which by the Leave of the said Captain Dent, Captain Keich & Mr. Lynes are Ordered to get made & his Excellency will pay them for them.

"His Ex^{cy} is pleased likewise to give & Allow to the said Poor people every Sunday a Mutton & as much Indian Corn as will Amount to Thirteen Shillings pr Week & orders Mr. Lynes to Consult Capt. Keech in Order to procure the same & his Excellency will pay them for it.

"Ordered that the person that reads prayers at the cool springs take an acct. of what persons Come thither who are cured & of what Distempers—paper (for this) being sent by the said Mr. Lynes."

Prayers twice daily, books of "Homilies" and "family devotions" as well as good Theophilus Dorrington's "reformed devotions" would seem indeed to meet spiritual needs, but a suspicion cannot help entering the mind that the bodily comforts of the visitors were probably less well provided for. There is no mention of provision being made for medical attendance or for nursing the sick. Whether a record of the cases treated as ordered was ever actually made, cannot be learned. It has certainly not been preserved.

By September 6th the pestilence had entirely disappeared, for the Council recommends to the Governor that he appoint a day of thanksgiving for the return of health through the great benefit of the Cool Springs and for the promise of bountiful crops. The following proclamation issued Oct. 22 shows the esteem in which the springs were now held:[7]

"And what in a more peculier and nearer manner affected this his Majestyes Province in God Allmightyes withdrawing his Afflicting hand of sickness from us and restoreing health to us wth severall beneficiall and healing springs of water called the Coole Springs which by his blessing haue wrought many Wonderfull and Signall Cures amongst Severall distempred and Impotent psons * * * * * * * he had appoynted Tuesday next being the 25 Instant to be sett apart for a day of publick thanksgiveing and rejoyceing therefore to be kept and observed by the Gen^{ll} Assembly and others att the Towne and Port of Annapolis and the 22^{d} of November next Ann arundell County and all other Countyes within this Province."

The reputation of the Cool Springs was not confined to the province of Maryland, for on the same day that the Governor issued his thanksgiving proclamation, he submits the following message to the Upper House, showing that its fame had extended at least as far as New York. His recommendation that the province should establish suitable buildings for the care of the sick was acted upon soon afterwards by the General Assembly.[8] His own offer to contribute twenty-five pounds toward the building of a hospital was a notable act of charity for the times, and is probably the first donation to a hospital in the colonies:

"The printed news lately by his Ex^{cy} received from New Yorke Delivers severall representations to him relateing to the Coole Springs in saint Marys County and (he) proposes that if the house doe Consent to have some small Tenem^{ts} built there in

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[7] Archives of Maryland, Vol. XXII, p. 157

[8] Idem., p. 158.

THE SECOND HOSPITAL IN THE COLONIES MARYLAN

By J. Hall Pl

Maryland may claim the distinction of having been the first of the colonies to agitate the question of establishing a hospital within its boundaries, for as early as 1638 we find the well-known pioneer priest Andrew White urging upon Lord Baltimore the necessity of such an institution. Nothing was actually accomplished, however, until the close of the century, when, in 1698, a hospital was established at the "Coole Springs of St. Maries." During this interval the Dutch East India Company, in 1658, had built at New Amsterdam, an almshouse and hospital, known as the "Old Hospital," or "Five Houses," of which the present Bellevue claims to be a direct outgrowth.[1] The "Five Houses" is probably the oldest hospital in the colonies, the Cool Springs dating second in the order of establishment. The statement frequently made that the Pennsylvania Hospital, founded in 1751, is the oldest hospital in the colonies, is thus not borne out by facts.

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a small proportion of the population, but in the years immediately following the revolution in England, which deposed James II. and placed a Protestant prince, William of Orange, on the throne, the feeling against the Catholics in all English-speaking countries was especially strong. In Maryland, Lord Baltimore, who was a Catholic, was deprived of his government, and in 1692 the province became for a time a royal colony with the Church of England as the established religion. Rumors of plots on the part of the adherents of Lord Baltimore to regain control of affairs had made the government unusually suspicious of any activity on the part of the Catholics.

We can infer that the success of the priests in spiritual matters was probably the reward of their labors in the actual care of the sick and dying during the epidemic, and we shall presently see the steps taken by the established church to counteract this influence.

The early summer found the pestilence on the wane and militia drills, which had been suspended on account of the epidemic, were resumed July 1 by order of the Council.[4]

The "Coole Springs" first comes to our notice in a letter from the owner of the springs and the adjoining lands to the Assembly, dated April 1, 1698.[5] The contents of this letter have not been preserved, but the brief entry upon the record made at the time of its receipt is most expressive: "As to Captn. Dents Lr. about the Coole Springs it is looked upon as an Idle Letter not worth an answer." If this indicated skepticism as to the worth of the springs, we shall see how that feeling was soon to give way to a very different one.

At a meeting of the Governor's Council held June 4, steps were taken to care for the spiritual welfare of those who were already flocking to the springs in search of health. We see now an adroit move on the part of the government to counteract the influence which the Catholic priests had already gained among the sick. The following quaint entry upon the Council proceedings seems worth quoting in full:[6]

> "Mr. Philip Lynes appearing at the Board and giving an Acct of some Extraordinary Cures lately wrought at the cool springs in St. Mary's County & that several poor people flocked thither to recover their health and limbs. His Excellency the Governor is to send & give to those Poor People at the said springs ten Bibles these to remain for the use of the poor people that Comes thither.
>
> "His Excellency also Orders that Capt. James Keech and Mr Philip Lynes do provide some Sober person to read prayers there twice a day to whom he will give 12 8/d Day & is pleased to lend the person that reads prayers there a book of Homolyes two Books of family Devotions & a Book of reformed Devotions written by Dr. Theophilus Dorrington out of which Books he is to read to them on Sundays.
>
> "Further Ordered that the said captain Keech & Mr. Lines acquaint Captain John Dent who is the Owner of the said House and Land that if he be willing his Excellency would have a reading desk & some Benches made in the New house there for the readers to read prayers & the people to sit on which by the Leave of the said Captain Dent, Captain Keich & Mr. Lynes are Ordered to get made & his Excellency will pay them for them.
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[7] Archives of Maryland, Vol. XXII, p. 157.

[8] Idem., p. 158.

the nature of an Hospitall he will giue twenty fiue pounds sterling towards the building thereof."

After some little discussion the following act was passed, Oct. 20, 1698, for the purchase of the Springs with the adjoining land and for the erection thereon of suitable buildings for the care of the sick:[9]

> "Whereas by the favour of Allmighty God there hath been of Late a discovery made of fountains of healing Waters Called the Cool Springs in St Marys County whose healing quality has been Experienced by many Impotent and diseased persons to their great help and Comfort and for that so great blessing, benefitt and gifts of Allmighty God may not be neglected but a right use thereof made it is most fitting and Convenient that a particular Care should be first had of all such poor Impotent persons as repaire thither for Care and for th^{t} purpose or other such Charitable or pious uses a small Tract or parcell of Land near adjoyning may be purchased thereon to build and erect houses for the Entertainment of the said poor, and fuell for fireing and other such necessarys for their reliefe the Delegates of this present Generall Assembly Therefore pray it may be Enacted..............that the persons hereafter named may and are hereby Appointed Trustees..........to buy & purchase in the name of our Sovereign Lord the King........for pious and Charitable uses fifty Acres of Land adjoyning to and in which the said fountains shall be included. And be it Enacted by the Authority aforesaid That Col John Courts Thomas Brooks Esqr Capt James Keech, Capt Jacob Morland of St Mary's County and Capt Philip Hoskins Capt John Bayne and Mr Benjamin Hall of Charles County or any three of them be & are hereby Impowered Authorized and appointed Trustees. . . . . . ."

The trustees appointed under this act met at All Saints Parish, St. Mary's County, November 24 to complete the purchase of the springs and land for 25 pounds sterling,[10] but there was apparently some hitch in the sale, as we later find the Assembly taking steps to condemn the springs and adjoining land.[11] The erection of small cottages seems to have been later determined upon instead of the large house which was first planned. For some reason the erection of buildings by the government was delayed until several months later, for July 3, 1699, we find the Assembly and Council still discussing the erection of buildings:[12]

> "Forasmuch as by our Iournall of the last Sessions we find that there was one hundred pounds sterl allotted for the use of the Cool Springs towards the purchase of fifty Acres of Land and for the building of small tenem^{ts} for the good and benefitt of such poor Impotent and lame persons as shall resorte thither and we find the Trustees appointed by Act of Assembly to purchase the s^{d} Land have agreed for and purchased the same for Twenty five p^{ds} sterl so that there is yet seaventy five pounds Sterl remaining towards the building of such Tenements.
>
> "We humbly pray that your Ex^{cy} will be pleased to appoint two of his Mat^{ys} hon^{ble} Councill to Joine into a Committee wth three of the members of the house to Consider of the Erecting such Tenem^{ts} Signed p Order
>
> Chr: Gregory Cl house Del.
>
> "The Honble Col. Henry Iowles and Thomas Brook Esqr Appointed to Joine with the Members of the house upon that Committee."

A few days before this the former owner of the Springs, Capt. John Dent, had petitioned the Assembly for the sole privilege of keeping an inn or "ordinary" at the Springs, which shows that although the pestilence had passed away more than a year before, its popularity had not yet waned. We have every reason to believe that the seventy-five pounds remaining after the purchase of the land was devoted to the construction of buildings, for there is nothing to show that the money was turned back into the treasury, or used for other purposes than that for which it was appropriated.

The Cool Springs now disappears as suddenly from view as two years before it had sprung into prominence. I can find no reference to it in the colonial records of the first half of the eighteenth century. With the passing of the great pestilence, its popularity must have waned, although we have no means of judging when this occurred.

With a view of tracing the subsequent history of the Cool Springs I have recently made a thorough inquiry among those familiar with the local traditions of Southern Maryland to discover, if possible, its later history.

The location of the springs is in St. Mary's County where the village of Charlotte Hall now stands. The place is said to have been renamed in honor of Queen Charlotte, wife of George III. The name "Saint Maries" recalls all that is romantic in the early history of the colony. The island of St. Clements, where the first landing was made by Leonard Calvert in 1634, and the city of St. Maries, the first seat of government, are both situated in this, the oldest county of the province. The history of Catholic Maryland was largely the history of St. Mary's. With the ascendency of Protestant influence in the colony and in England, the seat of government was removed by Governor Nicholson in 1694-95 from the city of St. Mary's to Annapolis. St. Mary's never recovered from this shock. Her importance rapidly dwindled. Even the former city of St. Mary's has almost disappeared from the map, being now represented by a church, a school and a few scattered buildings. Other once important towns in St. Mary's county are now as desolate as our own Joppa. The Cool Springs was destined to suffer a similar fate to that which befell St. Mary's City, for in the first three-quarters of the eighteenth century it passes entirely from our view, until in 1774, by an act of the Legislature, the now well-known Charlotte Hall School was established there, although the outbreak of the Revolution delayed the actual opening of the school for several years. It is probable that the site was selected largely on account of its healthfulness and the abundance of pure water.

The springs are situated at the head of a swamp, the water gushing out at several points from a bank of sand and stone.

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[9] Archives of Maryland, Vol. XXII, p. 279.

[10] Vestry Records of All Faith Parish, St. Mary's Co., Nov. 24, 1698. (Transcript in the Md. Hist. Soc.)

[11] Archives of Maryland, Vol. XXII, pp. 418 and 419.

[12] Archives of Maryland, Vol. XXII, p. 298.

[13] Archives of Maryland, Vol. XXII, p. 383.

There are three springs, all within thirty yards of each other. The water from the principal spring is now supplied to the school buildings. A recent analysis of the water from the two principal springs illustrates only too well what we see so frequently in this day and generation, and for which we need not go back two hundred years for an example: the water possesses two wonderful curative properties—purity and abundance. From mineral constituents it is remarkably free, as the following analysis shows:

Analysis of Water from Charlotte Hall, Made January, 1889.

Parts 100,000.	Spring No. 1.	Spring No. 2.
Total Solids at 1000 C	4.70	2.55
Silica	.38	.35
Iron and Alumina	.15	.08
Lime (Ca. O.)	.65	.30
Magnesia (Mg. O.)	.24	.03
Sulphuric Acid, Soz	.43	.26

Correct:

Signed, Harry J. Patterson, *Chemist.*

App'd

Henry E. Alvord, *Director.*

Note—In both cases, the Lime and Magnesia exist principally in the form of Carbonates.

Agricultural College, P. O., Md., Feb. 25, 1889.

Prof. R. W. Silvester, Charlotte Hall, St. Mary's Co., Md.

Dear Sir.—After your second letter, we were able to identify the two samples of water. Both have been analyzed, and the characteristic of each is special purity. It is not only free from organic matter, but *contains a very low percentage of mineral matter.* I enclose the two analyses. Authorities agree in the statement, that very good drinking water may carry six hundred parts per million, total solids of the character of those found in your samples. These two samples contain respectively but 251/2 and 47 parts per million of total solids. It is seldom that spring water is found with less.

Very respectfully yours,

Henry E. Alvord, *Director.*

What advantages our ancestors of two centuries ago possessed! With scarcely other facilities for analysis than those afforded by the senses, how easy it was to discover at their very door marvellous, healing properties in some abundant fountain of pure water, while we of this twentieth century must cross oceans or continents to sip our morning glass of water, in which our finer chemical methods are able to detect one or two grains of lithia or iron to the gallon. Do the seekers with Ponce de Leon, the early Marylanders crowding to the Cool Springs and the throngs at a modern European spa differ from one another in kind or in degree? Were the cures at the Cool Springs less real than many made to-day at Carlsbad?

The popularity of the Cool Springs was from the first doomed to be of brief duration. Neither the taste nor the smell of the waters was sufficiently bad to ensure them an enduring reputation. Had that enterprising inn keeper, Captain John Dent, but discovered the wonderful properties of a bath in the mud of the neighboring swamp, perhaps his descendants, instead of the rapacious hotel keepers of Marienbad or Franzenbad, might be reaping a harvest of American dollars at the mud baths of "Ye Coole Springs of St. Maries."

Instead of this, even the name Cool Springs is now almost forgotten. There is nothing to show that its waters were used to any extent medicinally except for a few years following the pestilence of 1697. Among the oldest inhabitants there is now no tradition which gives us the least clue of the subsequent history of this ancient health resort until the establishment there of Charlotte Hall School. By some it is even doubted whether special buildings for the care of the sick were ever actually erected by the State. For reasons which have already been given it seems almost certain that such buildings were erected. We know, however, that there were buildings and provision of some kind there for the care of the sick, from what we have already gleaned from the old records.

Among the people of the neighborhood the water is now supposed to be of some slight benefit in diseases of the kidneys, but even locally it has a very limited reputation.

I have told you all that I have been able to learn of this once famous Maryland health resort. That the Cool Springs should have had but a brief popularity must not lessen our appreciation of the efforts of Governor Nicholson and the Assembly to establish in this colony one of the first hospitals and sanatoriums in the provinces. A few years ago the Colonial Dames of America erected a tablet in the McCoy Building of the Johns Hopkins University, in memory of Governor Nicholson, in recognition of his efforts in behalf of education in Maryland—

TO
COMMEMORATE THE LIBERALITY
AND ZEAL FOR LEARNING
OF
FRANCIS NICHOLSON,
GOVERNOR OF MARYLAND,
BY WHOSE EXERTIONS AND BOUNTY
WAS FOUNDED IN 1696
THE FIRST FREE SCHOOL IN THE PROVINCE,
THIS TABLET IS ERECTED BY
THE MARYLAND SOCIETY
OF THE
COLONIAL DAMES OF AMERICA,
1900.

It seems unfortunate that some recognition could not have been made at the same time of his early attempt to establish a hospital for the care of the sick and suffering of the province and his own liberal contribution for the purpose. It seems especially appropriate to bring this early attempt to your attention at a time when an earnest effort is being made to establish a sanitarium for the care of the consumptives of our community. Shall we allow it to be said that our ancestors upwards of two hundred years ago were more zealous in the care of the sufferers from the unknown pestilence than are we of the victims of the great white plague?

SOME UNUSUAL FORMS OF MALARIAL PARASITES.

By Mary E. Rowley, M. D.

(From the Clinico-Pathological Laboratory, Massachusetts General Hospital. Photographs by Louis A. Brown.)

The varieties of parasites ordinarily to be found in the blood of Aestivo Autumnal Malaria are:

I. Ring-shaped bodies.

II. Crescents and ovoids.

In the blood of three cases of this fever, I noticed a number of parasites quite different from the above.

Those to which I desire to call attention are of two classes:

I. The first set of bodies are intracellular, elongated and sausage-shaped, extending transversely across the red cell nearly from side to side. The body of the parasite contains irregular openings, usually situated at its extremities.

The chromatin is in the form of dots arranged in a short series parallel to the long axis of the parasite and about midway between its extremities (Figs. 1-6).

Pigment was present in all the forms observed and was either scattered about the parasite without special arrangement or grouped at its ends.[1]

II. The other forms found would suggest a transition between the bodies just described and "crescents;" for example, Fig. 7, which shows a form distinctly curved on itself like a crescent, but of much looser structure, the chromatin arranged in a string of dots near one end, and the pigment at the periphery and not at the center as in most crescents.

Figs. 8 and 9 are evidently crescents, but show much more of the corpuscle than is usually to be seen and approach quite distinctly the appearance of Fig. 7, which I should hesitate to call a crescent.

We have, then, a suggestion of the means of formation of "crescents" out of the elongated intracellular forms above described, while these in turn can probably be connected (through intermediate forms) with the larger and heavier forms of ring bodies such as are shown in Figs. 1 and 2.

I wish to express my appreciation of the kind assistance given me by Dr. Richard C. Cabot in studying and interpreting the parasites above described.

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[1] In Kolle & Wassermann's Atlas of Handbuch Path. Mikroorganismen, Berlin, are figured some forms of quartan parasites not unlike those which I have found in aestivo-autumnal fevers.

NOTES AND NEWS.

Dr. Joseph Akerman, appointed House Medical Officer in 1900, but did not serve, is Superintendent of the James Walker Memorial Hospital, Wilmington, N. C.

Dr. Herbert W. Allen, House Medical Officer during 1900 and 1901, is Assistant in Clinical Pathology and in Medicine in the Medical Department of the University of California. Address: 546 Sutter Street, San Francisco, Cal.

Dr. John M. Berry, House Medical Officer during 1901 and 1902, is surgical assistant to Dr. W. G. Macdonald, of Albany, N. Y. Address: 186 State Street, Albany, N. Y.

Dr. Joel I. Butler, House Medical Officer during 1901 and 1902, is Resident House Officer in Surgery in the Massachusetts General Hospital, Boston, Mass.

Dr. W. J. Calvert, appointed House Medical Officer in 1898, but did not serve, is Assistant Professor of Internal Medicine, University of Missouri. Address: Columbia, Mo.

Dr. C. N. B. Camac, Assistant Resident Physician in 1896 and 1897, is Instructor in Medicine, Cornell Medical College, and Chief of Staff in the Department of General Medicine of the Cornell Dispensary. Address: 108 East 65th Street, New York City.

Dr. M. B. Clopton, Assistant Resident Surgeon in 1898 and 1899, is Visiting Surgeon to St. Luke's Hospital, St. Louis. Address: 2604 Locust Street, St. Louis, Mo.

Dr. Sydney M. Cone, Assistant Resident Surgeon in 1894 and 1897, is Clinical Professor of Orthopedic Surgery, Baltimore Medical College. Address: 821 Park Avenue, Baltimore.

Dr. George W. Dobbin, Assistant Resident Obstetrician from 1894 to 1896, and Resident Obstetrician from 1896 to 1899, is Professor of Obstetrics, College of Physicians and Surgeons. Address: 56 West Biddle Street, Baltimore.

Dr. William W. Farr, Assistant Resident Gynecologist during 1890 and 1891, resides at 39 Gowen Avenue, Mount Airy, Philadelphia, Pa.

Dr. A. L. Fisher, House Medical Officer during 1900 and 1901, is Assistant in Surgery in the Medical Department of the University of California, and Assistant Visiting Surgeon to Mt. Zion Hospital, San Francisco. Address: 546 Sutter Street, San Francisco, California.

Dr. H. A. Fowler, House Medical Officer in 1901 and 1902, resides at The Cumberland, Washington, D. C.

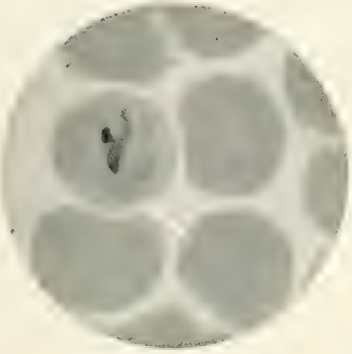

FIG. 1.

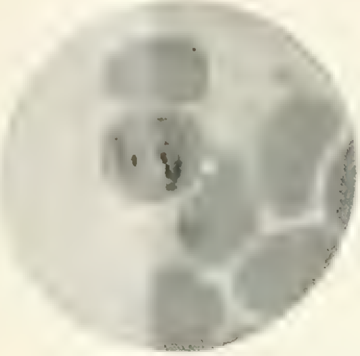

FIG. 2.

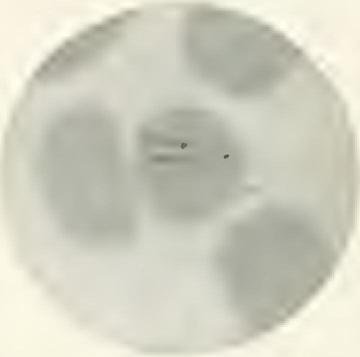

FIG. 3.

FIG. 4.

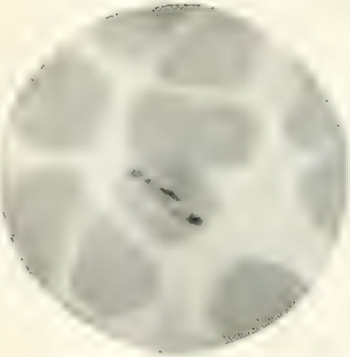

FIG. 5.

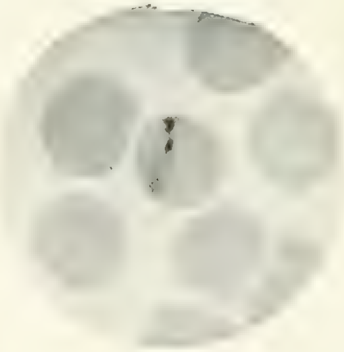

FIG. 6.

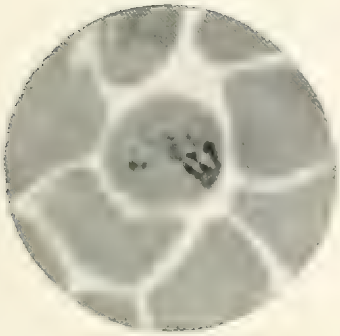

FIG. 7.

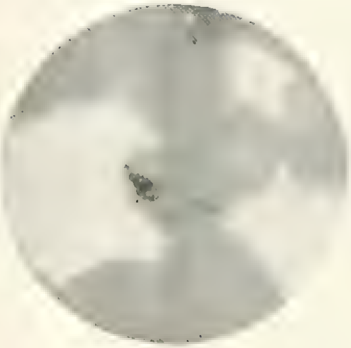

FIG. 8.

FIG. 9.

Dr. R. Edward Garrett, Assistant Resident Surgeon from 1895 to 1897, is First Assistant Physician, Maryland Hospital for the Insane. Address: Catonsville, Md.

Dr. McPheeters Glasgow, Assistant Resident Gynecologist in 1896, resides at 151 North Spruce Street, Nashville, Tenn.

Dr. Henry Harris, House Medical Officer during 1899 and 1900, is Assistant in Principles and Practice of Medicine, Cooper Medical College, First Assistant in the Medical Clinic, Cooper Medical Dispensary, and Visiting Physician, Pacific Hebrew Orphan Asylum. Address: 502 Sutter Street, San Francisco, Cal.

Dr. Thomas W. Hastings, House Medical Officer during 1898 and 1899, is Instructor in Clinical Pathology, Cornell Medical College, and Assistant Attending Physician, Department of General Medicine, Cornell Dispensary. Address: 72 West 87th Street, New York City.

Dr. R. F. Hastreiter, House Medical Officer during 1901 and 1902, is Physician in Charge of the Milwaukee Branch of the Summit Lake Sanitorium, Physician to the Protestant Home for the Aged, and Instructor in Anatomy in the Wisconsin College of Physicians and Surgeons. Address: 2036 Wells Street, Milwaukee, Wis.

Dr. Joseph H. Hathaway, House Medical Officer during 1901 and 1902, is Resident Pathologist, Free Hospital for Women, Brookline, Mass.

Dr. Carl H. Horst, House Medical Officer during 1902 and 1903, resides at 208 West Gakua Street, Butte, Montana.

Dr. J. A. Luetscher, House Medical Officer during 1899 and 1900, resides at 1025 Madison Avenue, Baltimore.

Dr. Irving P. Lyon, House Medical Officer during 1897 and 1898, resides at 531 Franklin Street, Buffalo, N. Y.

Dr. J. D. Madison, House Medical Officer during 1898 and 1899, is Chief of the Medical Dispensary, and Adjunct Professor of Medicine, Wisconsin College of Physicians and Surgeons. Address: 199 23rd Street, Milwaukee, Wis.

Dr. E. W. Meisenhelder, House Medical Officer in 1902 and 1903, is a member of the staff of the Barnes Hospital, Washington, D. C.

Dr. J. F. Mitchell, House Medical Officer during 1897 and 1898, Assistant Resident Surgeon from 1898 to 1900, and Resident Surgeon from 1900 to 1902, is Professor of Surgical Pathology, Columbian University, and Surgeon to the Dispensary of the University Hospital, Washington. Address: 1311 Connecticut Avenue, Washington, D. C.

Dr. G. H. F. Nuttall, Assistant Bacteriologist from 1891 to 1893, is President of the Tropical Medicine Section, British Medical Association, Examiner in Bacteriology and Tropical Medicine to the Royal Army Medical Corps, and Accessory Member of the Tropical Diseases Committee appointed by the Council of the Royal Society. Address: 3 Cranmer Road, Cambridge, England.

Dr. Mary S. Packard, House Medical Officer during 1897 and 1898, resides at 425 Angell Street, Providence, R. I.

Dr. Clement A. Penrose, House Medical Officer during 1897 and 1898, resides at 21 West Mount Royal Avenue, Baltimore.

Dr. Lindsay Peters, Assistant Resident Obstetrician during 1897 and 1898, and Assistant Resident Gynecologist during 1898 and 1899, resides at 1414 Gervais, Street, Columbia, S. C.

Dr. Hunter Robb, Resident Gynecologist from 1889 to 1892, is Professor of Gynecology, Western Reserve University. Address: 702 Rose Building, Cleveland, Ohio.

Dr. Carey P. Rogers, House Medical Officer during 1902 and 1903, resides at the Bisbee Building, Jacksonville, Fla.

Dr. Maurice Rubel, House Medical Officer during 1901 and 1902, resides at 4452 Ellis Avenue, Chicago, Ill.

Dr. Glanville Y. Rusk, House Medical Officer during 1900 and 1901, is Assistant in the Pathological Institute of the State of New York. Address: Pathological Institute, Ward's Island, New York.

Dr. Florence R. Sabin, House Medical Officer during 1900 and 1901, is Assistant in Anatomy, Johns Hopkins Medical School. Address: 1415 Linden Avenue, Baltimore.

Dr. Georgiana Sands, House Medical Officer during 1898 and 1899, resides at 348 North Main Street, Port Chester, N. Y.

Dr. C. P. Smith, Assistant Resident Surgeon during 1893 and 1894, is Surgeon to the Buffalo, Rochester and Pittsburgh Railway Company. Address: 481 Franklin Street, Buffalo, N. Y.

Dr. C. N. Spratt, House Medical Officer during 1901 and 1902, is a member of the staff of the Massachusetts Charitable Eye and Ear Infirmary. Address: 233 Charles Street, Boston, Mass.

Dr. A. L. Stavely, Assistant Resident Gynecologist in 1891 and 1892, and Resident Gynecologist from 1892 to 1894, is Gynecologist to the Garfield Memorial Hospital, and Clinical Professor of Gynecology, Columbian University. Address: 1207 Connecticut Avenue, Washington, D. C.

Dr. J. M. Taylor, Assistant Resident Gynecologist in 1900 and 1901, is located at the Pierce Building, Boise, Idaho.

Dr. Harry Toulmin, Assistant Resident Physician in 1889 and 1890, is Assistant Medical Director of the Penn Mutual Life Insurance Company. Address: 921 Chestnut Street, Philadelphia, Pa.

NOTES ON NEW BOOKS.

A Narrative of Medicine in America. By James Gregory Mumford, M.D., Assistant Visiting Surgeon to the Massachusetts General Hospital and Instructor in Surgery in the Harvard Medical School. Octavo, 508 pages. (*Philadelphia and London: J. B. Lippincott Company, 1903.*)

The work done, during the past few years on the history of medicine in the United States should be especially gratifying to all who take an interest in the recital of matters medical. The enthusiasm aroused for this study shows that the labors of Thacher, Beck, Toner and Quinan have not been in vain, for the subsequent delvings of Cordell, Packard and a host of others have brought to light much worthy of record about our doctors of former times and their surroundings. Mumford, already known by his writings on former Boston worthies, has recently published a most readable book, narrating many of the principal facts in the medical history of our own country. His charm of style causes the work to be with difficulty laid aside until the last page has been read.

He starts with the colonial era—a time when most of the doctors obtained their knowledge from apprenticeships, for few there were who could go abroad to Leyden, Paris, Padua or Great Britain, for a more complete education. The early doctors in Virginia are here touched upon and some mention is made of good old Deacon Fuller, of Mayflower fame. John Winthrop, Jr., is also referred to but is erroneously spoken of as Governor, in 1657, of the New Haven Colony instead of Connecticut, and asserted to be a founder of the Royal Society. As a matter of fact the Royal Society was organized in 1660, but was not incorporated until two years later, at which time Winthrop was proposed for membership by William Brereton and admitted some twenty days thereafter.

Other names, though not quite so luminous, are given full attention by Mumford. In his list of eighteen of the best known early Massachusetts physicians, Giles Firmin is written as Giles Fairman. An interesting man he was and we wish some account of him had been given other than the mere recital of his name, for he, in those early days, "did make and read upon the one Anatomy (skeleton) on the country very well" but despairing of earning his living as a doctor was "strongly set upon to study divinitie." His studies else must be lost, he says, for he found physick "a meene help," and later he did follow this course, returned to England and died in the ministry.

We must take strong exception to the statement that the seventeenth century record of Maryland was all but inarticulate. Previous numbers of this Bulletin have contained the record of those early times, as well as Dr. Quinan's articles in the Maryland Medical Journal and Dr. Cordell's recent book. These, with other data now accessible, show that the first suggestion for a hospital in the colonies was made in Maryland in 1638 (see Father White's letter to Cecilius, second Lord Baltimore); that the first carefully recorded autopsy was done five years later in this colony and was probably performed by George Binx, who is elsewhere styled Licentiate in Physick. There was, however, another doctor on the jury, Robert Ellyson, a barber-surgeon. This autopsy was on an Indian boy shot by his master and the report shows well how thorough and successful efforts were made to trace the course of the bullet and find its seat of lodgement. Then, too, some fifty-five years later the first sanitarium in the colonies was established at "Coole Springs" (now Charlotte Hall), St. Mary's Co., Maryland. Thomas Gerard and Luke Barber, alike prominent as physicians and statesmen, should have received some mention.

On page 29, it is stated that the physicians of the period nowhere sided with the madness of witchcraft. We wish this were true but the account of Bryan Rossiter's autopsy on "Kellies child" (see September number of this Bulletin), shows there was at least one notable exception to this statement. We regret that no reference is made to certain well-known Connecticut doctors of this period who have been brought clearly to light by the labors of Russell and others. Gershom Bulkeley, especially, should have been rescued from an undeserved oblivion.

In the story of the eighteenth century the trials and ultimate success of Boylston in introducing inoculation is attractively presented, but we think that Dr. Adam Thompson of Prince George's County, Maryland, should also have been named as he originated the "American Method" of inoculation. This method consisted mainly in the preliminary use of mercury and was also extensively employed by Muirson of Brookhaven, L. I., (Ezra Stiles in his diary says he was the first to use it) and Benjamin Gale, one of Connecticut's most famous clerical physicians. The latter especially should not have been slighted, for he was "one of the pre-Revolutionary American physicians who have left published records of valuable medical observations" (Welch).

In the pages following Colden, Cadwallader, the Charleston coterie, Morgan, Shippen and others of their time come in for their share of notice, and the founding of the early hospitals and medical schools in this country, is well told. The story of the Revolution, with the sorry ending of Church's career as well as the cruel injustice meted out to Morgan, makes an interesting chapter. For Benjamin Rush more space is reserved, and rightly we think, than for any of the others. Elihu Hubbard Smith, the founder of the first medical periodical in America, has a whole chapter devoted to him. Great ability is shown in selecting for special mention the most prominent physicians and surgeons of the early part of the nineteenth century. Among those of lesser notice, Waterhouse is said to have been the first to introduce vaccination to his countrymen. A common error, it is true, for John Crawford of Baltimore, practiced vaccination simultaneously with Waterhouse, in the summer of 1800. Dr. James Smith, also of Baltimore, is not spoken of at all, yet he did more than any one in this country to popularize vaccination and has been called by Quinan "the Jenner of America."

The later physicians and surgeons are finally considered—Chapman, Francis, Gibson, Jackson and Drake being given special mention. It seems to us that Charles Frick, of Baltimore, is entitled to be mentioned in this group, for he, cut off in his prime, was a well-known physician of marked scientific attainments. The story of the ether controversy and the founding of the American Medical Association, are well told in two of the concluding chapters. Altogether the author has written a most pleasing narrative and we congratulate him most heartily upon it. W. R. S.

A Text-Book of Operative Surgery. Covering the Surgical Anatomy and Operative Technic Involved in the Operations of General Surgery. By Warren Stone Bickham, Phar. M., M. D., Assistant Instructor in Operative Surgery, College of Physicians and Surgeons, New York; Late Visiting Surgeon to Charity Hospital, New Orleans, etc. Octavo of 984 pages, with 559 illustrations. (*Philadelphia, New York, London: W. B. Saunders and Company, 1903.*)

In this volume of nine hundred eighty-four pages the author attempts to describe most of the operations of general surgery, and a number of special operations of gynecology as well as of the surgery of the eye, ear, and genito-urinary tract. The descriptions are necessarily concise, but in most cases are sufficiently full to give a fairly satisfactory idea of the operations under consideration. The illustrations are numerous and add very decidedly to the value of the book. A special feature which the author introduces is a brief description of surgical anatomy preceding the description of the operation. We question the value of this for we believe that in most cases the surgeon will get his anatomy much more satisfactorily from a text-book than from such a brief review as is given in this book. As would be expected at a time when the progress of surgery is so rapid, many procedures are included which are not to be found in most of the older standard text-books; for example all the later methods of intestinal anastomosis are quite satisfactorily described, the modern methods of amputation, operations on the brain and heart, the Matas operation for aneurysm, etc. The author states in his preface that he has omitted the principles of operative surgery and anæsthesia, as well as the operations of plastic surgery, many of the operations more properly classed as the operations of special branches of surgery, and some of the variations of the operations of general surgery. Some of these omissions very greatly lessen the value of the book and we fail to see the reason for omitting some operations usually considered as belonging to general surgery while others are included; for example such operations of the specialty of gynecology as hysterectomy and oöphorectomy are included while a large proportion of operations on the male urethra, testicles, scrotum and prostate have been omitted as belonging to special genito-urinary surgery. We regret also to notice the omission of several important methods introduced by American surgeons, which are considered by many competent men the most satisfactory operations of their class; for example, Mayo's vertical over-lapping method of operating for the radical cure of umbilical hernia, Finney's gastroduodenostomy as a substitute for the older methods of plyloroplasty, Fowler's method of decortication of the lung for chronic empyema (often improperly credited to De Lorme), Halsted's latest method of operating for the radical cure of hernia, and his improvements on the operation for excision of the breast for carcinoma. Some of these are included in a recent text on surgery by a foreign writer. A number of out of date procedures are given, such as Loreta's divulsion of the pylorus, which has been abandoned by its originator, as well as practically every other surgeon in favor of other more effectual methods; cholecystendysis which is now practically never used. Such omissions and inclusions are a common fault of practically all text-books, but to our mind the greatest fault of this book is that frequently several methods are described without any suggestions being given as to their comparative advantages or disadvantages, or the conditions under which each operation would be preferable; for example we read in the description of sequestrotomy, "bone chips may be used in the cavity—or the entire thickness of the soft parts including periosteum may be inverted into the bottom of the cavity from each side and held in place by a nail or peg, or the cavity may be packed throughout with gauze." We believe that there are certain conditions under which some of these procedures would be absolutely contra-indicated, and that in most cases there is a choice which methods shall be adopted. Without a surgeon has experience enough to know which method would best be used it avails him little to know the operative technic. The lack of completeness of the book and the fact that in many cases it does not give any advice as to the choice of operation, will make some other book on operative surgery necessary for the less experienced surgeon, or for the general practitioner who is occasionally called upon to operate, and it contains no features of such value as to make it especially helpful to the experienced surgeon, who already has on his shelves the standard works on operative surgery. The systematic arrangement and concise, accurate descriptions together with numerous, excellent, illustrations of the sections on amputations, excisions, and ligations of arteries, the operations most frequently practiced by students on the cadaver, however, make the book well suited for use in the laboratory of operative surgery.

Atlas and Epitome of Operative Surgery. By Dr. Otto Zuckerkandl, privat-docent in the University of Vienna. Second edition, revised and enlarged, authorized translation from the German, edited by J. Chalmers Da'Costa, M. D., with 40 colored plates and 278 illustrations in the text. (*Philadelphia and London: W. B. Saunders and Company, 1902.*)

In the preface to the first edition of this volume the authors state that the book was designed mainly for students and that the operations described fully are those most suited for practical instruction in operative surgery on the cadaver. "Other operations, whose performance falls largely to the lot of the skilled surgeon, and whose practice upon the cadaver appears less important, are described concisely." As might be expected from this introduction a large portion of the book, over one-third the entire number of pages, is taken up with a description of amputations and the ligation of the main arteries of the body. Amputations are described in the main quite satisfactorily. In the remaining two hundred pages all the other operations are given; for most practitioners the most important part of operative surgery. It is almost unnecessary to state that in such a short space the descriptions of the operations are not only concise, but in many cases so brief as to be of no value to the operative surgeon, who is in search of information. A striking example of this is found in the description of operations on the biliary passages, which, at the present day, are of such great importance. Within the limits of a single page three important operations are "concisely" described; cholecystectomy, choledochotomy, and cholecystenterostomy. Three operations for hemorrhoids are also described on one page. It is needless to say that any adequate description is impossible within such short space. The book is distinctively German, and many operations frequently employed by American surgeons are entirely omitted. As an example of this may be mentioned Halsted's operations for the radical cure of hernia, and excision of the breast for carcinoma; the over-lapping method for large umbilical hernias, and the simpler methods of operating for femoral hernia. Another decided disadvantage of the book is that when several operations are mentioned nothing is said with regard to which is considered the operation of choice under various circumstances. The illustrations are numerous, many of them being showy colored illustrations, but for the purpose of the student and operative surgeon they are many of them far from satisfactory. With judicious, careful editing the book might have been made of considerable value, but the editorial notes are limited to a few lines of fine print scattered here and there through the book. The book may be well suited to the use of German students, but there are several books in English which we believe are better adapted to the use of American students.

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The Hospital Bulletin contains details of hospital and dispensary practice, abstracts of papers read, and other proceedings of the Medical Society of the Hospital, reports of lectures, and other matters of general interest in connection with the work of the Hospital. It is issued monthly.

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Report in Pathology.

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CONTENTS:

The Malarial Fevers of Baltimore. By W. S. Thayer, M. D., and J. Hewetson, M. D.

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HISTORIC OUTLINE OF CARDIAC PATHOLOGY AND CLINICAL ASPECTS OF CHRONIC MYOCARDITIS.[1]

By C. N. B. Camac, A. B., M. D.,

Visiting Physician to City Hospital; Chief of Medical Staff, Cornell University Medical College Dispensary, New York City.

I. Introduction.
II. Historic outline—Chronological Charts. Ancient Literature.
    1. Morgagni, 2. Avenbrugger, 3. Corvisart, 4. Laennec.
III. Anatomy—Radiographs.
IV. Physiology and Physiologic Chemistry.
V. Pathology. Pathological Classification in Contrast to Clinical Classification.
VI. Ætiology.
VII. Clinical Symptoms and Signs—Diagnosis.
VIII. Prognosis.
IX. Treatment.
X. Modern Literature—Conclusion.

INTRODUCTION.

I have selected for our study to-night the disease of the heart muscle, a subject which to-day engages and in the past has engaged the attention of the best scientific investigators. From the crude observations of Hippocrates and Galen to the scientific researches of our own time, we note the diligent search in the field of pathological histology, physiological chemistry, and physical diagnosis for more accurate knowledge of the ætiology and physical signs peculiar to this disease, whose onset is so insidious; whose destructive power is so subtle, and which is so frequently unrecognized until revealed by autopsy. When one observes at the autopsy table the frequency of myocardial disease unrecognized during life and the healthy heart muscle diagnosed in life as myocarditis, he is reminded of D'Alembert's story of the successful practitioner who, after conducting a prominent practice for thirty years, gave as his reason for retiring, that he was "weary of guessing."

It has seemed to me profitable to trace briefly the history of the development of our present knowledge of cardiac pathology and especially of myocardial disease, for as Cook, in the preface of his translation of Morgagni, says, "the various steps in the progress * * * ought not to be disregarded, for, in difficult research, we derive encouragement from the recollection, that although the exertions of an individual may not advance philosophy in any perceptible degree, yet, owing to the power of experience, and the successive influence of opinion, the most obscure and apparently unsuccessful inquirer may prove the first or the connecting link in a series of the most valuable discoveries." (Cook's Morgagni, Preface.)

---

[1] A lecture delivered to the post-graduate classes of the Johns Hopkins University, May, 1903.

The following charts chronologically arranged will serve, if you follow them, as a guide through the historic data which I am about to give:

CHART No. I.

HISTORIC OUTLINE. (CHRONOLOGIC.)

I. Epoch of Ancient Medicine. 1500 B. C. 300 A. D.
  A. Greek Medicine.
    460-377 B. C......Hippocrates......Heart could not be diseased.
    300 B. C...... School of Alexandria { Herophilus.......Synchronism of Pulse and Heart Beat.
    Erasistratus.....Discovery of Valves and Explanation of their Function.
  B. Roman Medicine.
    1st Century Celsus......Heart Disease in Animals, in Man by Analogy.
    131 210 A. D. Galen......Experimental Proof that Arteries contain Blood not Air.
II. Epoch of Mediæval Medicine 300 A. D. to 1400 A. D.
    Human body not dissected from 300 A. D. to 1224 A. D. (School of Salerno) or possibly not till 1306 (Mundino of Bologna).
    Ignorance..... Superstition......Isolated Observations.
    980-1036 Avicenna (Arabian Medicine) Peripheral Aneurisms.

In the epoch of ancient medicine (see Chart No. I) it is not till we reach Greek writings that any mention or hint of the heart as an organ subject to disease appears.

From the school of Alexandria (300 B. C.) we have a description of the valves and their functions by Erasistratus. Prior to this Hippocrates declared that the heart could not be diseased, thereby showing that the question of the possibility of its being diseased had arisen. In the Roman writings of ancient medicine—Celsus in the first century and Galen (131-210) in the second concluded by analogy from the diseased hearts of animals that man's heart may also be diseased, an observation which, according to Babcock, Galen made upon the athletes and gladiators. More important, however, than this was Galen's demonstration that the arteries contained blood not air. In the mediæval epoch (300-1400) anatomical research was spasmodic, and medical study, buried in superstition and ignorance, Avicenna's (980-1036) observation of peripheral aneurisms being perhaps the only one of importance. For sixteen centuries, a period extending from the epoch of the Alexandria school (300 B. C.) to the school of Salerno (1224), or more probably to that of Mundino (1306), the human body had never been dissected. (Chapman.)

Mundini or Mundino, professor of anatomy at Bologna during the latter part of the thirteenth century, "had dissected in eleven years only three human bodies" (Chapman). It is not, therefore, to be wondered at that the grossest ignorance prevailed.

CHART No. II.

HISTORIC OUTLINE—Continued. (CHRONOLOGIC.)

Epoch of Modern Medicine.......... ....1400-1900.

1440-1502	Benivieni	Anatomical and Pathological.
1511-1553	Servetus	Septum Imperforate. Pulm. Circ. Suspected and Described.
1514-1565	Vesalius	Aneurism of Aorta Diagnosed During Life. Interventricular Septum—"Invisible Pores."
1534	Massa	"Aneurism" of Heart, i. e., "Dilatation" and "Hypertrophy" of To-day.
1574	Fabricius	Valves of heart.
1590-1630 ?	Bonet	Fatty Infiltration or Degeneration of Heart Muscle.
1583	Cæsalpinus	Brief Description of Systemic Circulation.
1578 1657	HARVEY	CIRCULATION—PULMONARY and SYSTEMIC.
1597-1677	Glisson	Contractility of Tissue.
1628-1694	Malpighi	Capillaries.
1632-1723	Van Leeuwenhoek	Capillaries.
1638-1687	Steno	Muscular Structure of Heart.
1641-1715	Vieussens	Change of Apex Beat in Hypertrophy and Pericarditis.
1654-1720	Lancisi	Associates Asthma with Cardiac Disease.
1662-1738	Albertini	Recognizes Pulse of Aortic Regurgitation.
1666-1723	Valsalva	Anatomical Observations.
1682-1771	MORGAGNI	VALVE and MUSCLE LESIONS FULLY DESCRIBED. CASE OF ANGINA PECTORIS DESCRIBED—SYMPTOMOLOGY-PATHOLOGY.
1708-1777	Haller	Physiological Observations.
1722-1809	Avenbrugger	Physical Signs—PERCUSSION.
1755-1821	CORVISART	Physical Signs—WITH POST-MORTEM OBSERVATIONS.
1781-1826	LAENNEC	Physical Signs—AUSCULTATION.
1787-1872	Louis	Physical Signs and Symptoms—Acute Inflammation of Heart in Acute Disease—"Feuille Morte" Heart.
1768	Heberden	"Angina Pectoris" (term).
1776	Jenner	"Angina Pectoris," Coronary Aty. Sclerosis Suggested.

With the opening of the modern epoch (1400-1900) (see Chart No. II) anatomy was revived by Vesalius (1514-1565) and practical medicine and surgery were studied, and written upon by Benivieni (1440-1502) and Paré (1517-1590). From anatomical to physiological observations the steps were quickly taken. The valves and some idea of their function were more fully considered by Fabricius (1574), though the first study of these, as stated above, dates back to the school of Alexandria (Erasistratus, 304 B. C.). The pulmonary circulation was evidenced by the demonstration of the interventricular septum by Servetus (1511-1553) and by the declaration by the same observer that this septum was imperforated. The systemic circulation was considered by Cæsalpinus (1583).

Pathological observations, except for an aneurism of the aorta, diagnosed during life by Vesalius (1514-1565), an aneurism of the heart described by Massa (1534), were of little moment. The demonstrations of the systemic and pulmonary circulation by Harvey (1578-1657), of the capillaries by Malpighi (1628-1694) and Van Leeuwenhoek (1632-1723), of the muscular structure of the heart by Steno (1638-1687), of the contractility of the muscle by Glisson (1597-1677), and the general anatomical observations by Valsalva (1666-1723), make this hundred years the most important in the study of the anatomy and physiology of the heart and blood vessels. With these great fundamental questions answered, Morgagni's (1682-1771) splendid observations, clinical, but more especially pathological, mark the beginning of another and very important medical epoch—that of clinical and complemental pathological study. ·

From Morgagni's "Seats and Causes of Diseases," in which is recorded his close observation, we have the first system of symptomology corroborated by post-mortem findings. Avenbrugger (1722-1809) contributes the first of the physical sign methods, that of percussion. Corvisart (1755-1821), the physician to Napoleon I, corroborates by post-mortem observations methods of physical diagnosis, while Laennec (1781-1826), with his stethoscope and method of auscultation, completes the list of prominent figures in this, which might be called the Epoch of Physical Diagnosis.

Close upon these, indeed almost contemporaneous, comes that great teacher whose influence went far to mould European and American clinical medicine—Piérre Charles Alexandria Louis.[2] The normal structure and function fairly well understood, the symptoms and the signs of disease formulated, and post-mortem findings in the normal and diseased observed and correlated to the symptoms and signs, the century opened with an opportunity for deeper study, which has been embraced with productive results to investigators on myocarditis, but least of all to the clinician.

In support of this statement, let me quote to you what Corvisart wrote of myocarditis and diseases of the heart in general—now nearly one hundred years ago (1806). Corvisart wrote, "The muscular substance is what most essentially constitutes the central organ of circulation. This acts the principal part in its organization—since to the contractility of the muscular fibre the motions are entirely indebted, which gave impulse to the fluid which the heart causes to circulate."

"This single view is sufficient to make us feel how alarming the lesions which necessarily induce the alteration and sometimes annihilation of the properties of the muscular fibre.

"Though there is some difference in the structure between the ventricles and auricles, the parietes of these cavities[2] *have not less dependence on the same muscular tissue.* In the healthy state, in fact, the particular arrangement of the fleshy fibres, and their inconsiderable number[3] *seem barely to distinguish the tissue of the auricle from the ventricle,* and it is in cases of great dilatations or other affections that the parietes of these cavities lose their muscular character assuming a membranous appearance, or suffering other changes. * * * Scarcely any disease of the heart is less known than carditis. Let one try to decide which is the real tissue affected, or to discriminate this affection from several others with which it may be confounded."

"Is the inflammation of the heart," Corvisart goes on to say, "always very sharp and acute, or does it not sometimes affect an insidious, hidden progress which it appears, if not impossible, at least very difficult to distinguish?"

Again, dilatation and hypertrophy are referred to as follows:

"In the first species (active aneurism) the heart is dilated, its parietes thickened, the energy of its action increased.

In the second (passive aneurism) there is likewise a dilation but an alternation of the parietes and diminution of the energy in the action of the organ" (pp. 75-76).

These very early works which I am enabled, through the courtesy of Mr. Brownne, Librarian of the New York Academy of Medicine, to show you, may be considered as the inspired writings of the four great evangelists of medicine—the inspiration of these *bearers of good news* being *close observation.*

Standard Ancient Literature.

I. De Sedibus et Causis Morborum per anatomen indagatis (1762), Jo. Baptiste Morgagni (1682 1771).
  TRANSLATION: Seats and Causes of Diseases Investigated by Anatomy—By William Cook, 1824.
II. Inventum Novum ex percussione thoracis humani at signo abstrusos interni pectoris Morbos detegendi (1761), Leopold Avenbrugger (1722 1809).
  TRANSLATION: A New Method of Percussing the Human Thorax, etc.—By John Forbes, 1824.
III. Essai sur les Maladies et les Lésions Organique du Coeur et des Gross Vaisseaux—T. N. Corvisart, 1806.
  TRANSLATION: By John Forbes, also Gates.
IV. De L'Auscultation Medical ou traite du diagnostic des Maladies des Poumons et de Coeur—R. J. H. Laennec, 1819.
  TRANSLATION: By John Forbes, 1824.

I will not go further into the history of the study of myocarditis in our own times, as I shall have occasion to make use of many of the topics of this epoch in considering the different questions of myocardial disease. I refer you, however, to this table (see Chart No. III), and I think you will be struck with the absence of clinical observations in this, what might be called, the Epoch of Gross and Microscopic Pathology and Bacteriology.

Chart No. III.

HISTORIC OUTLINE—Continued. (Not Chronologic.)
19th Century.

Hasse (1810), Rokitansky (1804-1878)........ Bochdalek, Dittrich, Virchow (1821-1902).	Pathological Observations.
Lobstein	"Arteriosclerosis" (term).
Gull—Sutton..................................	do as a Disease.
Sobernheim (1837)........	"Myocarditis" (term).
Bamberger (1857)..............................	"Insufficiency of the Heart" (term).
Kreysig.	Heart Muscle Initial Seat of Inflammation.
Andral, Bouillaud, Bristowe, Frederick, Bard, Philipe............................	Interstitial Myocarditis.
Duplaix....	Periarteritis and Extension by Proliferation of Connective Tissue from Vessels.

---

[2] Much valuable information in preparing the above was obtained from Chapman's "History of the Circulation of the Blood," Stengel's "History of Cardiac Pathology," Whittaker's "Article on Myocarditis" and many old books kindly supplied me by Mr. Brownne, Librarian of the New York Academy of Medicine.

[3] Italics not in original.

[4] An Essay on the Organic Diseases of the Heart and Great Vessel from Clinical Lectures of T. W. Corvisart, Gates' Translation.

Debove, Haushalter, Huchard, Martin	Arteriosclerosis of Heart.
Weber, Ludwig, Schmiedeberg, Schäfer	Innervation of Heart.
Gunzburg, Wunderlich, Stokes	Acute Inflammation of Heart.
BIRCH HIRSCHFELD	Interstitial Proliferation. Gen'l Pathological Observation.
Leyden	Myocardial Inflammation; Acute and Chronic.
ROMBERG	Extensive Clinical and Pathological Observations.
Litten, Ziegler	Pyogenic Micro-organisms Cause of Myocarditis.
Councilman	Gonococci Cause of Myocarditis.
Allbutt, Meyers, Leitz, DaCosta	Muscle Lesions without Valve Lesions.
Bollinger	"Beer Drinker's Heart."
Loeb, Howell et al	Action of Inorganic Salts on Heart Muscle.
Krehl, Babcock, Gairdner et al	Clinical Contributions.

The epochs, as I have traced them, may be grouped as in this chart (see Chart No. IV).

CHART NO. IV.

EPOCHS.

Prior to 400 B. C.		Complete Ignorance.
400 B. C. 300 A. D.	Epoch of Anatomy No. 1	Beginning of Accurate Observation—Anatomic Facts.
300-1500		Decline of Anatomic Study—Superstition and Prejudice.
1500-1600	Epoch of Anatomy No. 2	Revival of Anatomy—Anatomical Laboratories.
1600-170	Epoch of Gross Pathology	Pathologic Study—(Gross), Pathological Laboratories—Symptomology and Morbid Pathology.
1700-1800	Epoch of Physical Diagnosis	Methods of Physical Examination—Clinical.
1800-1900	Epoch of Gross and Microscopic Pathology and Bacteriology	Pathological Histology. Bacteriology. Physiological Chemistry.

Each of the above represents the dominant consideration of its time.

ANATOMY.

Just as effective treatment depends upon correct diagnosis, so correct diagnosis depends upon a knowledge of the normal and pathological anatomy and physiology. I will ask you then, before we consider the clinical phenomena of myocarditis, to review with me the more important anatomical and physiological points in the cardiac mechanism. Briefly, the heart structure is as follows:

I. Endocardium, smooth muscle and elastic tissue, includes endothelial layer which is continuous with endothelium of blood vessels.
II. Myocardium—(Referred to in detail below).
III. Epicardium—Connective tissue containing elastic fibres; under it is fat.

The myocardium is described by Szymonowicz[5] as a net work, consisting of two sets of fibres, a superficial and a deep. *In auricles* there is a separate deep layer and a superficial layer common to both. *In ventricles* the superficial layer runs at right angles to the deep layer. "The middle muscular layers of the heart are called by Krehl the 'driving mechanism.' These fibres run in circles and almost transversely around the ventricles forming, when separated from the rest of the musculature, a cylinder opened above and below. These transverse hooked-shaped fibres shorten the cavity of the ventricle, while the middle circular layers compress it. The papillary muscles and the columnæ carnæ shorten approximate and at length come into close contact—pressed together by the contraction of the circular layer * * * in consequence of the packing together and thickening of the papillary muscle, and fleshy columns during the systole; the extent of the contraction of the muscular walls required to empty the cavity is materially lessened, and their expulsive force is thereby economized. * * * The contraction of the ventricles proceeds in a twisting manner; the blood is, as it were, wrung out of the cavity. * * * *The community of the musculature determines the synchronism of the two ventricles.*" (Schäfer.)

What interests us especially, then, is this muscular arrangement of the myocardium. The three layers:

1. Outer—runs right to left longitudinally.
2. Middle—runs circularly. "Driving mechanism" (Krehl).
3. Inner—runs left to right longitudinally; an arrangement which, together with the fact that "none of the strands of fibres begin and end in the same ventricle," and that they "terminate in the tendons of the papillary muscles," makes it of paramount importance to the proper function of the heart that the muscle be everywhere intact. I shall have occasion to speak of this arrangement again in the consideration of that important clinic phenomenon, arrhythmia.

The anatomy of the circulation of the heart will, I think, be appreciated by referring to this chart (see Chart No. V).

CHART NO. V.

CARDIAC CIRCULATION.

Right coronary (smaller) (anterior sinus of Valsalva) divides into two main branches:
  I. Descending—To each ventricle and ventricular septum.
  II. Transverse—Approaches transverse branch from left coronary.

Smaller branches from these to:
  Right auricle and ventricle.
1st portion of aorta.
  Pulmonary trunk.
  "Infundibular" over conus.
  "Marginal" to apex and to posterior and anterior surface of right ventricle.

Left coronary (larger) (left sinus of Valsalva) divides into two main branches:
  I. Circumflex (posterior transverse).
  II. Descending (anterior).

These supply by separate branches {
  Left auricle and ventricle.
  Ascending aorta.
  Left ventricle.
  Both ventricles.
  Vent. septum.
  Pulmonary artery. Quain.

Right coronary—Circumflex descendens septi:
  "End Arteries in Dog."—Porter.

Relative Sizes:

Smallest—1. Septi.	Next—2. Rt. coronary.
* Next—3. Descending of Lt. C. * Anterior branch of.	Largest—4. Circumflex of Lt. C.

"Smaller the vessel the least likely, if plugged, to cause arrest of heart."
—Porter.

* No. 3 "Artery of sudden death."—Osler.

The most important clinical considerations are the anastomoses and the pressure. Porter says:

"Michaelis concludes that the coronary arteries are not terminal because a skillful injector has succeeded in making

---

A Text Book of Histology, Szymonowicz, page 83–131. Translated by J. B. MacCallum.

an injecting liquid pass from one artery through communicating branches to another. * * * "

"No one," says Porter, "so far as I know, has denied that one coronary could be injected from another. Conheim himself makes special mention of the passage of liquids through the communicating branches under pressure. Everybody agrees that the coronary arteries anastomose. It is not the absence but the character of the anastomosis that is the basis of present pathological teaching. The incontestable fact is, that the anastomosis *is too slight to permit a collateral circulation sufficient to keep a vascular area alive after the closure of the artery which supplies it.*"

"The idea of terminal is physiological not anatomical. Terminal arteries differ from other arteries in that the peripheral resistance in the anastomosing vessels is too great to be overcome by the blood pressure in any of the arteries. * * * *The resistance in the communicating vessels and not their size is the factor of the first importance.*"[6]

In injecting these bullock hearts, radiographs of which I pass around (see Plate III) the following interesting point came up: Under 5 lbs. pressure, i. e., 10 inches or about 215 mm. of mercury, the injecting liquid (5% gelatin and cinnabar) was forced through the anastomosis. Under 3 lbs., 6 inches or 160 mm., it was not. I do not know what the blood pressure in the bullock is, but in the horse it is 11 lbs. 9 oz. (Kirke). This knowledge would enable us to say whether the anastomosis is only anatomical or physiological. (I wish to thank Doctor Sudler for his assistance and valuable suggestions in injecting these hearts.) The injection of the human heart under 130 mm. pressure (normal blood pressure) would or would not force the injecting liquid through the anastomosis, and we would obtain some information (in a relaxed heart to be sure) of the pressure needed to force the liquid through the anastomosis.

A word about the

Innervation of the Heart.

Though this is of great importance in the clinical consideration of myocarditis; in Schäfer's opinion the blood supply and intact muscle tissue is of more importance than the nervous machinery in the maintenance of the automaticity of the heart. The automatic action of the heart has been the subject of much study. From the important work of Brothers Weber in 1845 to that of Ludwig and Schmiedeberg in 1871, and of Schäfer in 1881, the consideration of the vagus and sympathic nerves as being concerned in the inhibition or in the augmentation or acceleration of the cardiac action has received much confirmatory experimental proof. Of the ganglia Schäfer[7] says (p. 200), " * * * The intrinsic cardiac ganglion cells belong to the same system as the extrinsic cardiac and vaso-motor ganglion cells, and there is no justification whatever for ascribing special central nervous system qualifications to the one and not to the other."

"The sequence of the contractions of the different parts of the heart," Schäfer goes on to say, "is not dependent upon the presence of the ganglion cells any more than the heart beat itself. *It is due to morphological differences in the muscles.*"

I shall have occasion to speak of this more fully when we come to consider clinically the heart sounds.

The nerve supply is remarkably rich as shown in Berkeley's beautiful specimens—in the Pathological Laboratory of this School. The question of the presence of a vaso-motor mechanism in the heart is an important one. Schäfer says, "Each systole does partially cut off the heart muscle from its blood supply, and at each diastole the injection of the coronary arteries aid in the dilatation of the heart. * * *

"Roy and Adami have shown[8] that vaso-dilators pass to the heart by the vagus, and vaso-constrictors by the sympathetic" —and Newell Martin has shown[9] that with excitation of the vagus and during asphyxia the coronaries dilate.

It seems possible to imagine that this vaso-dilatation could act during systole against the pressure of the contracting muscle and dilatation during systole—thus enabling the heart to utilize its blood supply. So important does this cardiac vaso regulating seem, that the fatal character of sclerosis of the coronaries with its terrible clinical phenomena are suggested as an inevitable sequence. An unstable vaso-motor mechanism, such as one sees in neurotics, would account for the palpitation observed in these people.

The blood pressure, according to Newell Martin and Sedgwick, in the coronary artery and aorta as shown by tracings synchronously taken, is identical for the aorta and the coronaries.[10] These are all facts of great clinical significance.

I must mention here what seems the most important contribution in physiology towards the clinical understanding of myocardial disease. I refer to the works of Howell, Loeb, Greene and others on the muscle contraction. While work on this subject was done prior to that of these observers —theirs has the most practical application. Stated briefly it is that variation in the quality and quantity of inorganic constituents of the circulating or surrounding fluid have different effects on the contractility of muscle.

The conclusion is that these inorganic salts play an important part in the automaticity and rhythmicity of the heart action. The great significance of these observations will be seen at once, and the knowledge of the chemistry of the blood of victims of myocardial disease becomes of immediate clinical importance. In this connection is the interesting fact that, "A strip from the mammalian heart, even when taken from the apex of the ventricle, will beat regularly at its own rate of rhythm apart from the beating of the rest of the heart;

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[6] Porter: Jour. Ex. Med., 1896, Vol. I, pp. 55-56. Italics not in original.

[7] Text-Book of Physiology, 1900, pp. 182-188.

[8] Philos. Trans., London, 1892, Schäfer, p. 166.

[9] Trans. Med. Chir. Faculty of Maryland, 1891, Martin, p. 291.

[10] Quoted by Schäfer, p. 13.

provided that care be taken to keep intact the circulation of the blood through the coronary vessels supplying the strip."[11]

We see then that the—

I. The Muscle.
II. The Circulating Fluid.
III. The Vessels—and the
IV. Nerves.
} Must be considered in the clinical study of myocardial disease.

Pathology.

In the study of the pathology of the myocardium—probably the greatest researches and richest contributions on the subject have been made. While these studies have aided materially in understanding better the clinical phenomena, attempts have been made *to apply clinically the many pathological subdivisions of disease of the myocardium differentiable on post-mortem examination only.* Clinical research has, I think, been frequently bewildered in consequence.

Corvisart's statement with reference to subdivisions of "Carditis" may with advantage be quoted here. He says: "This separation of the affections * * * has in our time been extended much too far; the idea may be beautiful in theory, even great advantage may be derived from it in the study of the science, but in practice, it does not lead to useful conclusion."

I give on these charts clinical and pathological subdivisions from several authorities, and it will be seen that the statement above made is borne out (see Chart No. VI).

Chart No. VI.

Clinical and Pathological Subdivisions.

STRÜMPEL (Practice of Medicine).
  I. Interstitial Myocarditis.
  II. Idiopathic Hypertrophy (mechanical strain).
  III. Acquired do (hypoplasia of aorta; resistance).
  IV. Congenitally Weak Heart (ordinary demands too much).
  V. Fatty Heart.

JAMES (Reference Handbook of the Medical Sciences).
  I. Acute Interstitial Myocarditis.
  II. Parenchymatous Deg. of Myocardium.
  III. Segmentation and Fragmentation.
  IV. Abscess.
  V. Tuberculosis.
  VI. Syphilis.
  VII. Tumors.

WELCH (unpublished).
  I. Acute Interstitial Myocarditis.
    1. Circumscribed.
    2. Diffuse.
  II. Hyaline Necrosis of Myocardium.
  III. Chronic Fibroid Myocarditis (with coronary arterial sclerosis).
  IV. Fragmentation of Myocardium (with fatty degeneration).
  V. Brown Atrophy.

OSLER (Practice of Medicine).
  I. Coronary Artery Disease.
  II. Acute Interstitial Myocarditis.
  III. Fragmentation and Segmentation
  IV. Parenchymatous Degeneration.
  V. Fatty Heart
  VI. Brown Atrophy.
  VII. Amyloid Degeneration.
  VIII. Hyaline do
  IX. Calcareous do
} With clinical conditions corresponding to each.

Birch Hirschfeld.

Inflammation of Myocardium.
1. Acute pathogenic, probably never idiopathic.
  (a) Propagation from an inflamed neighboring tissue.
  (b) By embolism.
  (c) Infectious parenchymatous myocarditis.

Pathological Types.
  (a) Purulent myocarditis, often in connection with an ulcerous endocarditis; or with pyaemia (embolus), typhoid fever, rheumatism.
  (b) Diffuse infectious inflam. of the myocardium. In typhoid, diphtheria and scarlet fever.
  (c) "Myocardite Segmentaire" (Renaut).

2. Chronic (myocarditis fibrosa). In arteriosclerosis: arteriosclerotic myocarditis.
  After infectious diseases: infectious myocarditis.
  Krehl { In valvular lesions.
    Hypertrophy of the heart.
  Syphilis.
  Alcohol.

The Arteriosclerotic Myocarditis—In Spots.
  " Strips.
  " Spots and Strips.

Douglass Powell—(Allbutt's System).
  I. Impairment secondary to general blood conditions.
  II. Impairment secondary to altered blood-supply.
  III. Impairment due to senile changes.
  IV. Impairment arising from functional strain.
  V. Impairment of inflammatory origin—Myocarditis.
  VI. Growth.
  VII. Parasites.

The division given by Birch Hirschfeld, like that of Welch, is more purely pathological, and that of Douglass Powell in Allbutt's System is more purely clinical, but in each instance a sharp line between the pathological and clinical is not drawn. The clinician is the greater offender.

It will be seen from these tables, that while a certain uniformity in the pathological consideration of myocardial disease exists—there is little to aid the clinician. The difficulty exists, I think, in not making a sharp distinction between those conditions which can be differentiated clinically—from those which can be detected by post-mortem examination only. If we make this sharp distinction the clinical list will dwindle materially. Following then Romberg, Rosenbach, Fraenzel and most German clinicians, the *clinical subdivision* on the first column of this chart results (see Chart No. VII).

Chart No. VII.

SUBDIVISIONS OF MYOCARDIAL DISEASES.

Clinical Ætiological	Factors	Pathologic.
ACUTE	ACUTE—	ACUTE—
Insufficieny of Heart Muscle with or without Valve Murmers.	1. Fevers (acute) Typhoid, Diphtheria, Typhus, Small Pox, etc.	1. Myocarditis, Interstitial or Parench. Deg.
	2. Pyaemia, Gonococci and other Pyogenic org's.	2. do
	3. Pericarditis (acute).	3. do
	4. Endocarditis (acute).	4. do
CHRONIC	CHRONIC	CHRONIC—
	A.—Diseases of other Organs and other Parts of Cardio. Vascular System.	
	1. Arterio Sclerosis without Angina Pectoris.	1. Hypertrophy.
	2. do do	2. Coronary Aty. Disease.
		3. Fibrous lesions. Anæmic Necrosis. Septic Infarct.
	3. Angina Pectoris without General Arteriosclerosis.	

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[11] Schäfer, p. 188.

	4. Endocarditis (chronic) Valvular Lesions.	4. Hypertrophy—Brown Atro'y.
Insufficieny of Heart Muscle with or without Valve Murmurs.	5. Pericarditis (chronic).	5. do Parench. Deg.
	6. Diabetes.	6. Fatty Deg.
	7. Nephritis (chronic).	7. Hypertrophy.
	8. Diseases of lung (chronic).	8. do Interstitial Myocarditis.
	B.—Systemic.	
	1. Old Age.	1. Fatty Deg. Brown Atro'y.
	2. Wasting Dis. and Cachexia.	2. do
	3. Obesity.	3. do Overgrowth.
	4. Phosphorus Poisoning.	4. do Deg.
	5. Alcohol.	5. Fibrous lesions.
	6. Syphilis.	6. do
	7. Interstitial Intoxication.	7. Parench. Deg.
	8. Beer Drinking.	8. Hypertrophy.
	9. Anæmia (acute and chronic).	9. Fatty Deg.
	10. Prolonged Fevers of Infections.	10. do Hyaline Deg.
	C.—Mechanical.	
	1. Strain (athletes) 2. Overwork. Mt. Climbers Porters, etc. 3. Insufficient Exercise. 4. Congenitally Weak.	Hypertrophy usually with some of the above.
		Myocarditis Fibrosa may be in Spots, Strips, or both.
		Fragmentation and Segmentation may occur in Fibrous Lesions, Fatty deg. Infarction.

This commits us to no more than we can ascertain clinically. In considering the ætiology, as will be seen presently, this list can as Romberg suggests be extended without departing from clinical accuracy.

Ætiology.

In considering the ætiology, it will be well to lay down the following broad laws:

I. Intact muscle and equilibrium of the nervous mechanism—are essential to rhythmicity of cardiac muscular action.

II. Equilibrium of nervous mechanism and rhythmicity of cardiac muscular action—essential to adequate and uniform blood supply to heart tissue.

III. Pure blood uniformly and adequately supplied are essential to proper metabolism.

IV. Any agent interferring with these essentials will cause:

1. Faulty metabolism.

2. Lowered resistance and remote consequence which, in themselves, may become factors in still further disabling the heart muscle.

This leads us to the consideration of many conditions (see Chart No. VII, second column), which, in former classifications, have come under pathological consideration, but which we may consider clinically without taking into account histological differentiations. These latter must not be neglected, but should not be introduced clinically *to the exclusion of signs and symptoms.*

It is impossible to discuss in a brief space disease of the coronary vessels and acute myocarditis—although these properly belong to this subject. Beyond brief reference to these I will not go, but refer you to Doctor Osler's monograph on "Angina Pectoris" and to the chapter on Arterial Sclerosis in Doctor Babcock's "Disease of the Heart and Arterial System"; also to H. Donner's "Ueber Arteriosclerosie," published in Stuttgart.

Specimen.

This specimen, which was brought to my attention by Dr. Otto H. Schultze, is remarkable in that it shows slight myocarditis, with healthy coronaries, and was the heart of an individual who met sudden death due to plugging (as can be readily seen) of the orifice of the left coronary artery.

I will confine the balance of the paper to "Chronic Cardiac Insufficiency."

1. Hypertrophy without myocardial disease.

2. Hypertrophy with myocardial disease.

This cardiac condition, called also by Fraenzel "Idiopathic Enlargement of the Heart," comes on those past middle life, usually men who have led lives in which the essentials to good metabolism have not been supplied. Either the supply of blood has been vitiated by the introductions of poisons into the system, as alcohol in excess, syphilis, improper food; or the demands have been too great either through the muscular or nervous system, or both these groups of causes have been at work.

Gerhardt, Romberg, and Krehl are opposed to the view that overwork alone can act as a factor, while Dehio compares the process which takes place with overwork, to the dilatation of the abdominal walls in pregnancy, etc., but with the difference that the heart muscle can hypertrophy and thus compensate. When degeneration of the muscle accompanies this he refers to the theory (so extensively accepted some time ago), of the compensatory growth of connective tissue supporting the degenerating muscle fibre, which in time is replaced by connective tissue—with resulting cardiac insufficiency.[12]

Sluggish circulation due to sedentary life has been considered as an ætiologic factor, but Piery points out that sluggishness is only a condition favorable to the harmful influences of poisons and injections (alcohol, tuberculosis, rheumatism, etc.), and is not itself, as proven by experiment, capable of producing cirrhosis of liver and myocardial disease.[13]

Chronic interstitial nephritis is an undoubted factor. The work of Howell, Loeb, and others already referred to has given this factor a new importance. The inorganic constituents of the urine varying greatly as they do in nephritis would suggest the possibility of a regulating mechanism whereby those substances which produce muscle contraction are increased or decreased as the demands upon the muscle happen to be. This does away with the mechanical theory to a large extent. It presents many interesting questions and is worthy of careful clinical investigation.

Schneitz first called attention to diabetes as associated with cardiac weakness, and considered the cardiac weakness more threatening than the diabetes itself. J. Mayer found in 380 cases of diabetes 82 with hypertrophied and weak heart muscle. Schott frequently detected glycosuria in patients in whom the condition had been overlooked by the physician sending the patient to Nauheim.[14] Heavy eating, heavy drinking, especially of beer (Bollinger), and a tendency towards obesity are potent factors in myocardial disease. The fact that excessive beer drinking is more commonly associated with myocardial disease, than excess in the use of other stronger alcoholic drinks, has raised the question whether the alcohol is the factor or not. I know of no satisfactory answer to this question, though many interesting theories suggest themselves. Romberg asserts that Havana cigars are more injurious to the heart than other brands. Syphilis and the congenitally defective system are also factors.

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[12] Dehio: Schmidt's Jahrbücher der Med., 1891.

[13] Piery: Arch. Gen. de Med., lxxviii, 1900.

The psychological considerations, like the mechanical, seem to be secondary rather than primary factors. Worry, grief, anxiety, shock or fright, coming when the damaged muscle is doing its best, may prove just too much, and in this way appear to be the initial agents in a progressively failing heart.

The hypertrophied heart is considered on an experimental basis (rabbits) by Romberg and Hasenfeld to possess a reserve force equal to the normal, but such a heart cannot dilate as does the normal, and is therefore unable to stand strain.[15]

The frequency with which men of active mental habits and inactive bodies, men of large business interests, speculators, upon the soundness of whose judgment and the promptness with which it is given much depends, are victims of coronary and myocardial disease is a common observation.

The life of high tension, with often an undue license in times of relaxation, presents a combination of causes peculiarly suitable to the development of these diseases.

A stock broker, who with evidence of myocardial disease was under my care, described an attack, which he had upon the receipt of the news of Mr. Cleveland's Venezuelian letter, which would have seriously involved a large investment had he not in the short space of ten minutes manœuvred a transfer. His heart, he said, seemed to stand still, then as if bounding from his body plunged against the chest wall. He attempted to write some instructions, but had no control over his hands. He was able to ring his office bell and send for his secretary. Mechanically he instructed him, while his heart he described as fluttering like a frightened bird in a cage. He thought he was going to die. His secretary dispatched, he lay upon his office sofa, becoming as he thought unconscious. In ten minutes the secretary returned, and aroused his employer with the statement that the transfer had been successfully made, and that the news of the Venezuelian letter had spread "all over the street." It was about an half hour before his heart quieted down. This was two years before any other symptoms had developed, and five years before his death.

This is only one of a hundred such incidents as occur hourly in the speculating world, and it is not surprising that in such a business "Wine is mentioned in the bond." A few days ago, I saw in the Cornell Dispensary a case with pronounced arrhythmia dating from a shock received by the patient 12 years previously. The shock was produced by the sudden death of the patient's husband, of which the patient was a witness. The attacks of arrhythmia in this woman are paroxysmal, lasting about three weeks, and recurring about twice a year. The initial attack lasted about two months, and followed immediately upon the shock. I have notes of a similar case of three years' duration.

Symptoms and Signs.

In considering the symptoms and signs we can, I think, with profit return to Corvisart's division into 1st, 2nd and 3rd stages. It is to the 1st and 2nd stages that I would ask you to give special attention.

We are too prone to study the hospital cases and neglect the close observation of those minor ailments of private patients, and dispensary cases. Is it not here, if due attention be given, that heretofore unobserved signs and symptoms of the onset of this insidious disease will be detected?

Perhaps the first thing the well built, active man complains of is "is not feeling himself" and of "irritability" over small matters. These, to be sure, are complaints common to many conditions. They should not be unrecorded. Increase in weight when associated with even slight dyspnœa is an important symptom. This latter is often described as "feeling tight about the chest." Add to these, slightly disturbed sleep, numbness in the hands and feet, a lessened mental acumen, not the old time energy in getting to business, and the first stage may be considered complete. With the beginning of the second stage, it may be a few months or several years later, the patient decides to consult a physician.

We must now look to the clinical methods available. The nipple line as a landmark should be abandoned—it is too uncertain in our present pursuit for a more accurate method. The mid-clavicular line should be marked first; then the mid-sternal line; then the costal angle. With this done one may proceed to various observations.

Inspection.

A word about the heart movement as visible on the chest wall. "In man," Schäfer[16] says, "the pericardium is suspended above by the stout cords of the deep cervical fascia; below it is attached to the central tendon of the diaphragm in such a manner as to form a triangular box of considerable strength and rigidity. In this box the heart is slung. *Almost all lateral movement of the heart is thereby prevented*,[17] and since the central tendon of the diaphragm is a fixed point, the heart likewise cannot descend. It is agreed by nearly all observers that the apex does not move up to the base, but the base moves down towards the apex. The latter remains practically a fixed point."

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[14] Schott: Wiener Med. Woch., 1899.

[15] Arch. Exper. f. Path. Med. Phar., 1897.

[16] Text-Book of Physiology, p. 6.

[17] Italics not in original.

"*The primary factor* (he goes on to say, page 35) *is the hardening of the muscular mass*,[17] the secondary factor, the erection of the ventricles upon the base of the heart. The impulse is felt at a *different spot in each position of the body* [17] owing to the influence of gravity acting on the heart."

From these statements we see the point of maximum impulse depends for its character upon the activity of the muscular tissue; clinically therefore we must consider:

1. The position of the patient;
2. An impulse which may be felt, not seen;
3. An impulse which may be seen, not felt;
4. Entire absence of impulse to both touch and sight;
5. Wavy impulse;
6. Multiple impulses;
7. Impulses which have not corresponding beats at wrist.

1. Krehl reminds us that an absent impulse may be due to the maximum point being behind the rib.

2. The apex beat is often displaced without any disease of the heart (individual varieties).

3. We do not find a point of impulse when the intercostal spaces are too narrow; if the lung is thickened; in œdema; in emphysema of the chest wall, and in exudates of the pericardium, and Cabot[18] points out that—

4. The point of maximum impulse is produced not by the apex but by some part of the right ventricle.

5. The impulse which is visible and not palpable, I have seen in a case of incompetence with dilatation, but without murmurs. The diagnosis of myocardial disease had been made; autopsy showed mitral insufficiency with a normal myocardium. The case was seen for the first time in that deceptive stage of incompetency of valvular disease.

Specimen: The heart I have here; and you will see that the myocardium is quite normal.

The observation of the P. M. I. and its character tells us little about the condition of the muscle unless taken in conjunction with other signs.

Percussion.

The instrumental percussion has, I think, no advantages over the hand method; Sansom's pleximeter is the most satisfactory, though I have not employed the Ebstein glass pleximeter, for which much accuracy is claimed. The use of this latter in the method of palpatory percussion will be found fully described in Schwalbe and Ebstein's Hand Book and in the Proceedings of the Internat. Congress at Rome, 1894. Broadbent and Bezley Thorne claim much accuracy for the method of auscultatory percussion. Rather than advocate any one method, it is advisable to employ several, and it will be found that they either corroborate each other, or that a line is found confused by two methods and must therefore be considered uncertain. Moritz's[19] observations by radiograph are claimed by Ebstein to be not more accurate than by palpatory percussion. Karfunkel,[20] however, considers observations with the fluoroscope the surest method, and employs this in routine examination of the heart. Heitler states, as demonstrated by Giovani and Potain, that the relation of other viscera to the heart is clinically an important one. Heitler finds, with a large area of heart dullness, small pulse and a large area of liver and spleen dullness, and vice versa, that *if he strongly percusses or shakes the liver the pulse which was previously small immediately becomes large and full and the area of the heart dullness is decreased.*

A. Abrams[21] observed by means of the Roentgen ray that on rubbing the skin in the precordial region a contraction of the myocardium occurs. The myocardial contraction is more manifest in the left than in the right ventricle. The contraction is not sudden. In children it is about two minutes, and furthermore the cardiac recessions continue even after the source of cutaneous irritation is removed. This amounts to one inch on either side. This phenomenon is called by A. Abrams "Heart Reflex."

Abrams conclusions are: 1. Lung dilatation follows the exercise and bath treatment, the lung acting as an excretory channel for the overburdened heart.

2. The cause of the lung dilatation is dependent upon cutaneous irritation.

3. A decrease in the volume of the heart also ensues and is likewise provoked by cutaneous irritation (not by the vasomotor stimulation).

4. If in a given case of increased cardiac dullness, which has been carefully outlined, we vigorously rub the skin of the precordial region and note after a minute (the time for the abolition of the lung reflex) a reduction in cardiac dullness, we are justified in concluding that we are dealing with cardiac dilatation, and not with pericardial effusion. What is the value of the heart reflex, as an index to the condition of the myocardium? Valuable in this connection is the normally hyperresonant line from the left axilla to the umbilicus pointed out by Sir Wm. Gairdner.

Auscultation.

It is, however, in the heart rhythm and sounds that we get early evidences of myocardial disablements.

Instruments more delicate than the stethoscope are needed, such as a clinical microphone. The phonendoscope is a crude instrument, but it is a step in the right direction. Oertel's stethoscope, which I will demonstrate presently, enables one to measure more accurately the relative intensity of the heart sounds.

Among the early signs arrhythmia and tachycardia are perhaps the most important. Musser[22] puts tachycardia, feeble, small pulse, dyspnœa and arrhythmia—the latter sometimes alone—as the most important early signs of myocardial disease. Krehl considers arrhythmia as pathogneumonic of myocardial involvement (see Figs. A, C, pp. 37-38). These signs then deserve special study.

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[18] Boston Medical Journal, Study of 196 Cases of Valvular Disease.

[19] Verhandl. der 18th Cong. f. Inner. Med. in Wiesbaden, 1900.

[20] Ztschr. f. Klin. Med., xliii, 1901.

[21] Med. Record, N. Y., 1901.

[22] Med. News, 1902.

Engelman, W. His, Jr., and Schäfer explain the different rhythmical power of different parts of the heart by morphological differences of the muscular tissue, and not upon the presence or absence of ganglion cells.

"The beat of the heart (says Schäfer,[23] p. 180) depends upon the (inherent) rhythmical power of its muscular tissue * * * some parts beat more easily than others, because their rhythmical power is greater * * * The sequence of the contractions of the different parts of the heart is due to a peristaltic wave of contraction, which starts from the most automatically rhythmical tissue and travels over the rest of the heart with varying speed, quickest over the tissue, which has become modified, so as to approach more nearly in its properties to ordinary striated muscle; more slowly over those parts which retain a more embryonic character, while at the same time, owing to the absence of modification of the tissue *between the auricles* and ventricles whereby it still retains its original more rhythmical but slower conducting power, the useful, purposeful pause between the auricular and ventricular contractions is brought about." And on p. 195 he says: "Any irregularity in the beat at headquarters will tend to be compensated by the time the ventricle contracts, so that the contractions of the ventricles will occur at much more regular intervals than elsewhere. Seeing that the main importance to the economy is to insure a regular ventricular beat, it is clear that this more or less complete obliteration of any irregularity in the rhythm by means of *the varying of conduction* at *different*[24] phases of the beat is a very important factor in maintaining the efficiency of the heart."

This is assuming that the muscle is intact; break any link in this chain and arrhythmia will result. The sequence of muscular contraction is from the auricles through the transverse fibres to the circular fibres and finally to the papillary muscles. The degree of arrhythmia will depend upon the portion of this muscular machinery, as well as the amount involved.

Radasewsky[25] compared in six cases the pathological lesions of the heart with the signs during life, and concludes that only in those cases where there was a diffused connective tissue degeneration of the muscles of the auricles was there irregularity and arrhythmia cordis. In those cases where the auricles were not much involved—even though the lesions in the ventricles were profound—the action of the heart was regular and rhythmical.

Krehl also calls attention to this association between arrhythmia and disease of the auricular muscle fibres, and explains it by a disturbance at the beginning of the sequence of the heart cycle. The results of arrhythmia and tachycardia Krehl sums up as follows:

1. Incomplete filling of heart chambers.
2. Overfilling of heart chambers.
3. Incomplete emptying of heart chambers.
4. Disturbed nutrition of heart.

I am following at present four cases of tachycardia—two alcoholic, which have continued at the rate of 120-130 per minute for three weeks, and two tobacco hearts, which ran between 100 and 120. There is more intermittency in the tobacco than in the alcoholic hearts. In one of the alcoholic cases there was no arrhythmia until the tachycardia had lasted for two weeks. In connection with the tobacco hearts, I would like to call attention to the possibility of poisoning from the constant handling of the dried tobacco leaf in making cigars and cigarettes. We have had several cases of what appeared to be tobacco poisoning, in which no other ætiologic factor presented itself. No reference beyond amblyopia is made to this, as far as I could find in Oliver's "Dangerous Trades."

The position of the patient while under examination must be carefully considered by the clinician.

Langowoy,[26] in a study of influence of the position of the body on the frequency of the heart beat says: "There is increased action in changing to the sitting position from the horizontal, because of the muscle work required in maintaining this position, because of the greater blood pressure on the heart and vessels, and consequent greater activity of the ganglia, and because of the greater pressure in the cranium with consequent irritability of the heart center in the medulla. In individuals with heart lesions, the heart action will be increased in changing the position from the horizontal to the vertical, as long as the ganglia retain their normal irritability. In some cases of insufficiency the normal irritability of the ganglia is not disturbed. In rare instances a disturbed irritability precedes the appearance of symptoms of insufficiency. In such cases the absence of an increase in frequency or even a diminution in the frequency on the patient assuming a sitting posture is a bad sign heralding an insufficiency."

The instruments devised for observing the various characteristics of the heart beat are many. The sphygmograph, the tonomotor, the pulse pressure gauge and the cardiograph are some of these. Of the cardiograph, Krehl and v. Frey are of the opinion that a unit of normal cannot be established even in one individual. The instruments of Oliver, Gaertner and Riva-Rocci for determining the blood pressure have been much used; the latter being the one almost exclusively used at present in Germany. This instrument has been reported on in this country by Cushing and Janeway. A very useful clinical modification has been just (February, 1901) devised by Janeway.

Bock (Munich),[27] by using the Oertel stethoscope, to which I have already referred, makes several valuable deductions (see Plate II). Bock was, with this instrument, able to measure the *relative* intensity of the heart sounds in the healthy adult. His figures are as follows:

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[23] Loc cit.

[24] Italics not in original.

[25] Ztschr. f. Klin. Med., 27, 1895.

[26] Deutsches Arch. f. Klin. Med., Bd. 58.

[27] Die Diagnosis der Herz Muscular Krankungen.

I. Mitral sound	40
II. Pulm. sound	18
III. Aortic sound	20

Thus the mitral normally has double the intensity of the aortic. In the neurotic heart, while the intensity of all the sounds is 2 to 3 times that of normal, each sound retains its normal *relative* intensity.

Bock analyzes the heart sounds in the following manner:

First sound: Muscular and valvular—accentuation depends upon the power with which the papillary muscles contract. Information about the muscles of the left ventricle especially is obtained from attention to this sound.

Second sound: Valvular—semi-lunars of the aorta and pulmonary artery. Accentuation depends upon the rapidity with which the valves close. The rapidity of the closure depends upon the pressure in the aorta and pulmonary artery. The pressure depends upon:

I. The power of the ventricles.
II. The resistance the blood meets.

At the aortic area—first sound tells of muscular power alone. Second sound tells us of a muscular power and valvular integrity.

A weak first sound at this area with an accentuated second sound would therefore suggest a feeble muscular power, or great arterial resistance.

At the mitral area—accentuated second sound occurs with fever, venus stasis, kidney disease, and circulatory disturbances in general.

In fatty hearts, with sclerosed coronaries, Bock calls attention to the (muskelgeraüsch) muscle sound—a rubbing, grating or scraping (schaben) which is not heard in fatty hearts without arteriosclerosis. This intramural murmur is a subject of great interest.

Krehl, in speaking of hypertrophy, warns against the conclusion that a weak first sound at the apex indicates a weak contraction, and gives as an example the hypertrophy with aortic insufficiency in which a weak first sound often occurs. This he explains by the slow contraction of the hypertrophied heart, the sound depending for its loudness upon the rapidity with which the heart contracts, and the rapidity with which the tension terminates. This explains why the first loud sound occurs in mitral stenosis and neuroses. The accentuations in hypertrophy he sums up as follows:

Hypertrophy of the right ventricle—accentuation of second pulmonic.

Hypertrophy of the left ventricle—accentuation of the second aortic with increased resistance of apex beat and strong pulse.

These then are some of the symptoms, signs and instruments by which we may detect the early stages of myocardial disease. In the third, or late stage, while there may be many signs and symptoms, yet the time for accurate observation has passed. How frequently are the murmurs of a well-marked valvular lesion entirely missing at this stage. So with myocardial disease, the confusions of sounds is such as to render their differentiation impossible. In this stage it is either sudden death from unrecognized myocardial disease, or the tumbling over heart; the Cheyne-Stokes respiration; the œdema all herald the end and are too confused for differential diagnosis. It is, therefore, in the first and early part of the second stages that we must seek for signs by which to make the diagnosis. It is at this time, as in the early stages of *pulmonary tuberculosis, that we may hope by treatment to aid our patient.*

Prognosis.

In considering the prognosis Romberg divides chronic myocardial diseases into two stages: The duration of the first stage he places at from 10 to 23 years; variation in pulse and heart function with dilatation of the right and left ventricles takes place at this time. The second stage extends over a period of from 2 to 3 years. The average of 176 cases in this second stage was 14½ months. Morrisey[28] concludes from the study of 250 cases that the chief guides in prognosis are:

1. Efficiency of the heart.
2. Degree of hypertrophy.
3. Conditions of the organs other than the heart.

His advice is "give your prognosis on the best suppositions—treat your patient on the worse."

Treatment.

Of treatment I will say only a word. Perhaps in this diseased condition, as in many others, we take with advantage Napoleon's remark that "Life is a fortress * * * why throw obstacles in the way of its defense. Its own means are superior to all the apparatus of your laboratories."

The essentials of treatment may be summed up in the following: Rest, hygienic measures, encouragement, freedom from care, yet with pleasant occupation, exercise—active and passive. These pulse charts (Figs. A, C) show the variation in morning and evening pulse rate in a man with hypertrophy without valve lesions—also the effect of the resistant exercises upon the rate of the pulse.

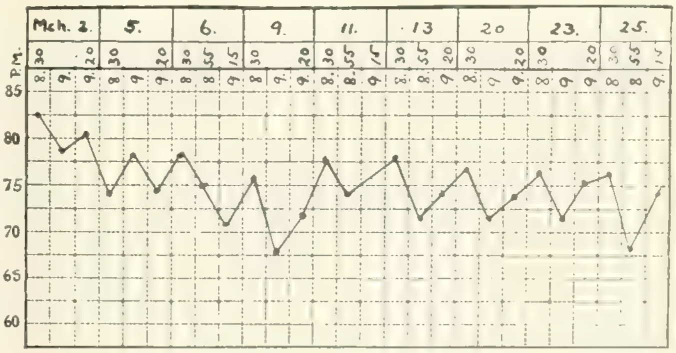

Fig. A.—Chart of evening pulse rate. Influence of 45 minutes of resistant exercises.

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[28] Med. Record, 1900.

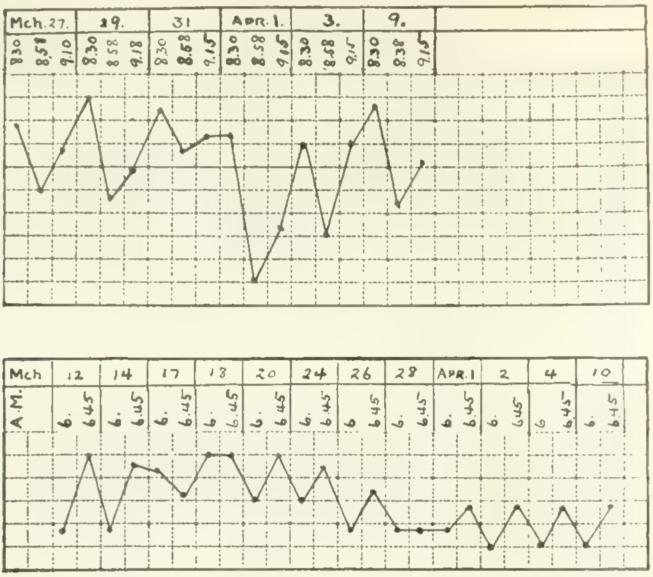


Fig. C.—Chart of morning pulse rate. Influence of 45 minutes of resistant exercises.

I show you here two charts representing the action of the Nauheim Saline baths given artificially (see Plate IV); you will see the striking change in the apex beat and cardiac outline. The principle of these baths depends upon a cutaneous irritation, which leads to a filling of the superficial vessels, with consequent relief to the congested heart and liver.

For a very thorough article on treatment, I would refer you to the chapter on "Treatment of Valvular Disease" in Doctor Babcock's book on "Diseases of the Heart and Arterial System."

"Cases," as Abernathy says, would probably "communicate more information in fewer words than descriptive or narrative," but unfortunately we must acknowledge even to-day Corvisart's statement made 100 years ago, "That a sufficient number of cases have not been collected to answer positively these questions; how does it happen," says Corvisart, "on dissection of some individuals that died of certain diseases * * * whose prognosis it is impossible to establish, how does it happen, I say, that, in such subjects the heart is observed in a morbid state which denotes actually a previous inflammatory diathesis, when the disease has presented in its progress neither signs or symptoms peculiar to simple *carditis?*" (pp. 73-74.)

There are many valuable modern writings on this subject which might be recommended; the following will, I think, be found standard and practical:

Schwalbe & Ebstein: Handb. der Prac. Med.
Babcock: "Diseases of the Heart and Arterial System."
Krehl: Nothnagel's System.

I acknowledge freely that this subject not even in one of its branches has in this brief space been covered. I shall feel, however, that our evening has not been misspent if I have aroused your interest in this subject of myocardial disease, and pointed out our great need for closer clinical observation. In closing I should like to emphasize the following:

1. The normal anatomy and normal physiology of the heart must be closely studied by the clinician.

2. The knowledge of the pathological anatomy and physiology is essential to clinical study.

3. The study of myocardial disease must be greatly extended by bedside observation. This can only be done by an honest limitation of our clinical conclusions to the evidence at hand.

4. The diagnosis must be made in the early stages of the disease.

5. Even with the best methods, the diagnosis of chronic myocardial disease at least is difficult, and its nature obscure.

Let me call your attention again to Chart No. VII, and urge the importance of conducting the clinical investigation from the *clinical viewpoint,* which the first column of this chart represents. The second column of the chart, that of ætiologic factors, represents in its relation to the first and third column the proper sequence of our inquiry; and in the third column appears the pathological probabilities. In the present state of our clinical knowledge of chronic myocardial disease we can consider only whether the muscle is *competent* or *incompetent.* Finer differential diagnoses, so commonly indulged in, are mere terms bewildering and dissipating the attention of the clinician from closer observation.

I can conclude with no better advice than that of Malpighi to his students: "Study nature and communicate matters of fact. Systems are ideal and mutuable, observations and experience are solid and unchangeable."

STUDIES IN TYPHOID FEVER.

SERIES I-II-III.

The papers on Typhoid Fever, edited by Professor William Osler, M. D., and printed in Volumes IV, V and VIII of The Johns Hopkins Hospital Reports have been brought together, and bound in cloth.

The volume includes thirty-five papers by Doctors Osler, Thayer, Hewetson, Blumer, Flexner, Reed, Parsons, Finney, Cushing, Lyon, Mitchell, Hamburger, Dobbin, Camac, Gwyn, Emerson and Young. It contains 776 pages, large octavo, with illustrations. It gives an analysis and study of the cases of Typhoid Fever in The Johns Hopkins Hospital for the past ten years.

The price is $5.00 per copy. Only a few copies of the volume are on sale. Those wishing to purchase should address their orders to the Johns Hopkins Press, Baltimore, Maryland.

ILLUSTRATIONS OF OERTEL'S STETHOSCOPE FOR MEASURING THE RELATIVE INTENSITY OF THE HEART SOUNDS.

FIG. 1. Stem of Stethoscope showing millimeter scales, one vertical measuring 40 millimeters, and one tranverse measuring 15 millimeters.

Outer and inner tube which can be moved so as to convert stem into a completely closed tube (Fig. 1) or into an open tube laterally (Fig. 2). This opening may be accurately measured by means of the vertical and transverse millimeter scale. Fig. 3 shows an opening of 3 square millimeters.

FIG. 2.—Same. Shutter entirely open forming open tube, opening measures 15 × 40 millimeters + 600 square millimeters.

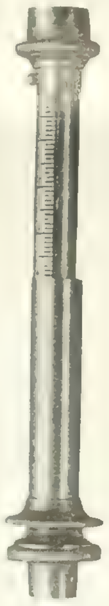


FIG. 1

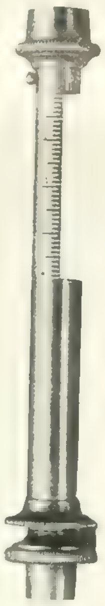


FIG. 2.

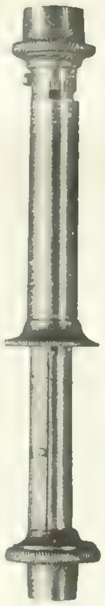


FIG. 3.

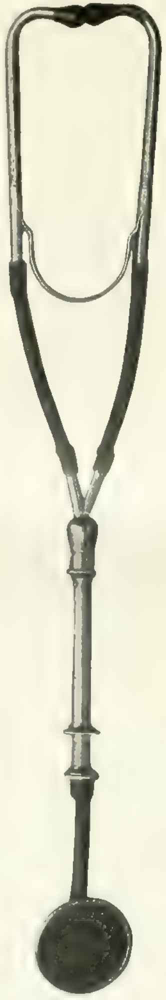


FIG. 5.

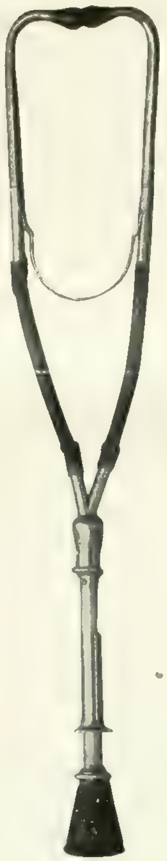


FIG. 6.

FIG. 3.—Same. Shutter partially closed, opening measures 3 square millimeters. The mitral sound is twice as loud as the aortic, i. e., at opening of 20 square millimeters aortic sound is no longer heard, at opening of 40 square millimeters mitral sound is no longer heard; at opening of 18 square millimeters pulmonary sound is no longer heard.

This does not mean that the normal heart sounds, in all individuals, are lost at these figures; it refers to the relation of the sounds to each other in an individual.

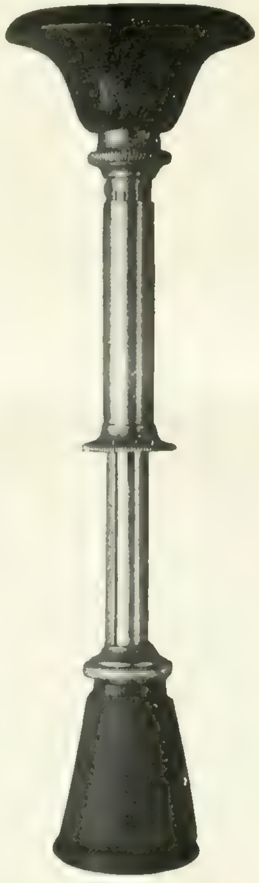


FIG. 7.

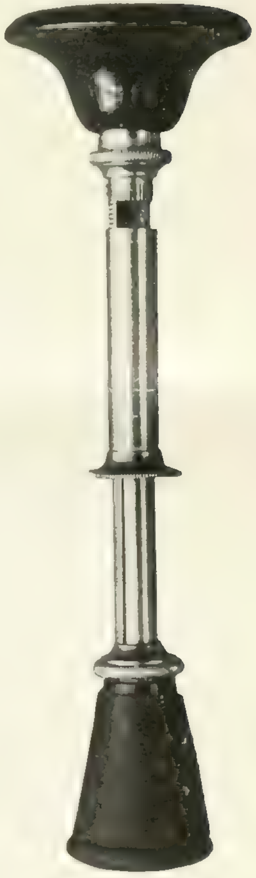
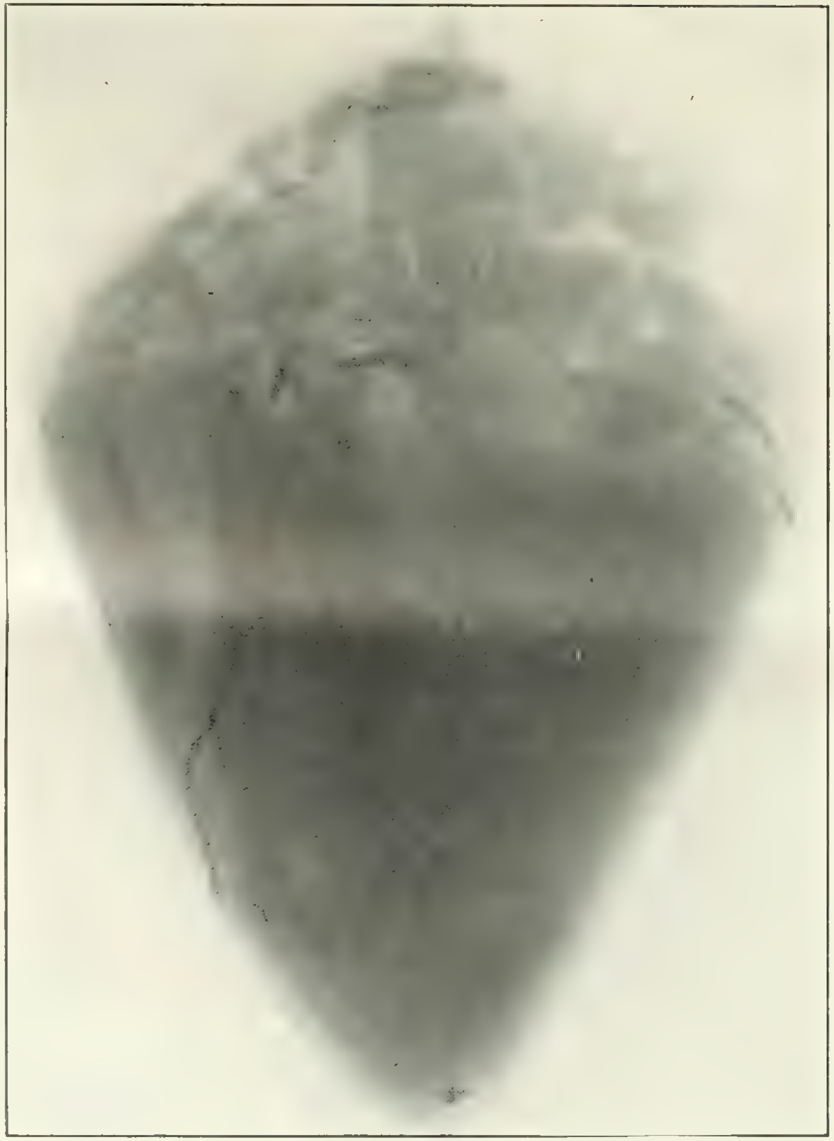


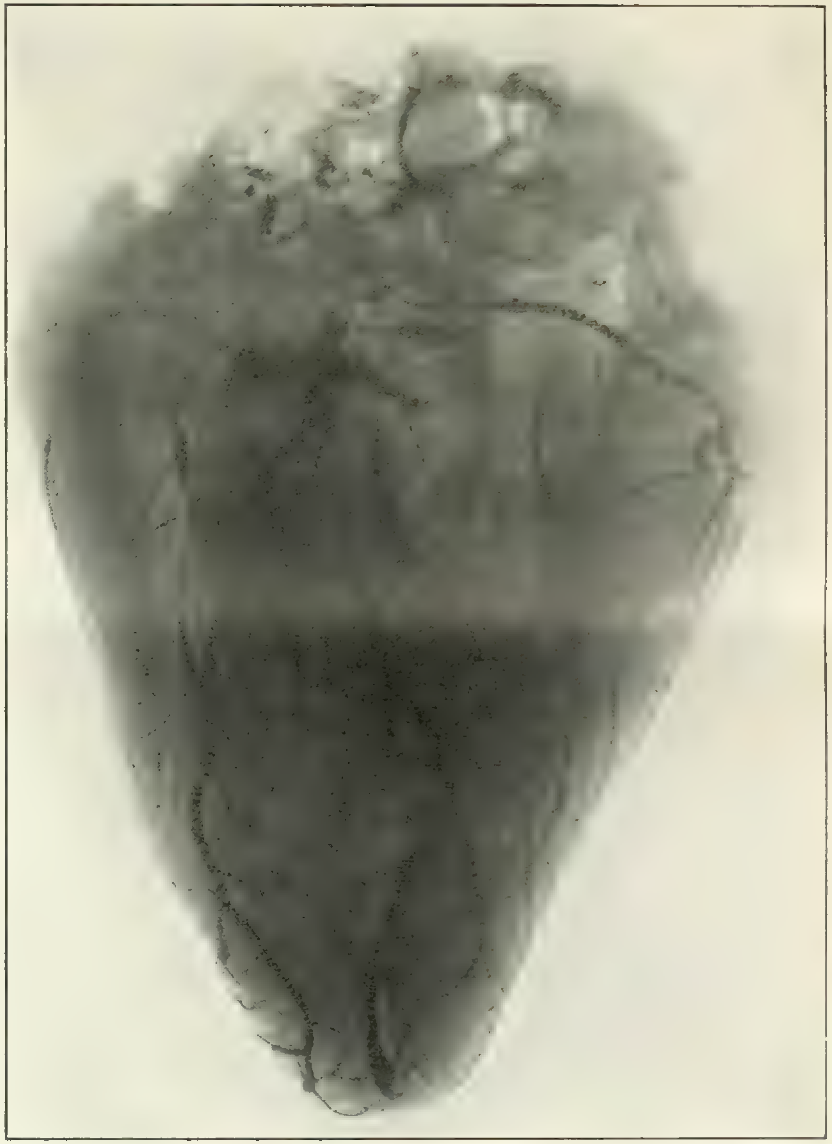
FIG. 8.

FIGS. 5, 6, 7, and 8.—Stem with various aural, etc., attachments.

PLATE III.



Bullock's heart injected right coronary—with 5% gelatin and cinnabar. Air pressure below 5 lbs., 6 in. mercury. Injecting fluid *not* forced through anastomoses to left coronary.



Bullock's heart injected—left coronary only—with 5% gelatin and cinnabar. Air pressure below 5 lbs., 10 in. mercury. Injecting fluid forced under this pressure through anastomoses into right coronary.

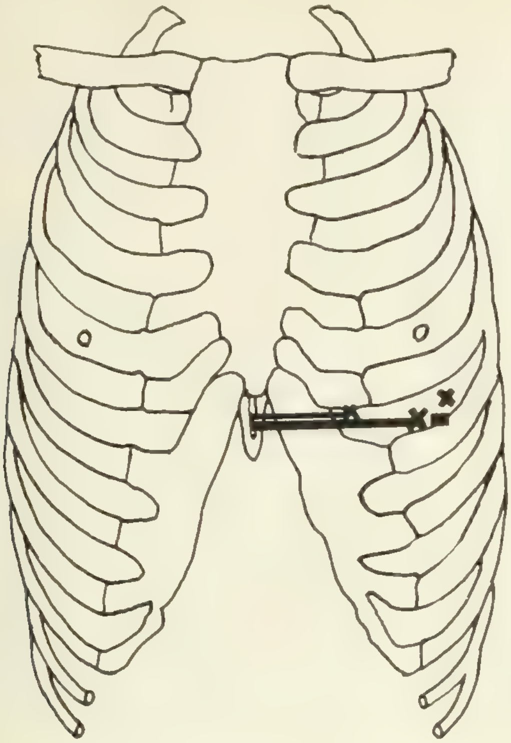


FIG. 1.—Hunt. Feb. 12. Before bath No. 1, strength No. 1. Point max. imp., 5th space, 13½ cm. from median line; after bath, point max. imp., 5th space, 11 cm. from median line. Feb. 13, no bath given. Point max. imp., 5th space, 10 cm. from median line. Feb. 14, bath No. 2, strength No. 1. Point max. imp. after bath 5th space, 8 cm. from median line. Feb. 15, no bath given. Point max. imp. not located. No signs (physical or post-mortem) of effusion.

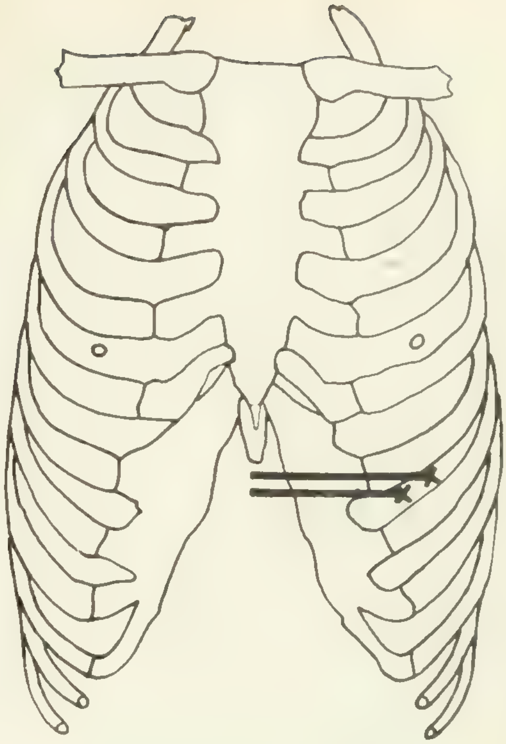


FIG. 2.—Larber. Before bath No. 1, strength No. 1, point max. imp. 14 cm. from median line. After bath, point max. imp., 12 cm. from median line. Length of time in bath, five minutes.

Figs. 1 and 2 illustrate the *immediate* influence of the baths upon the point max. imp.

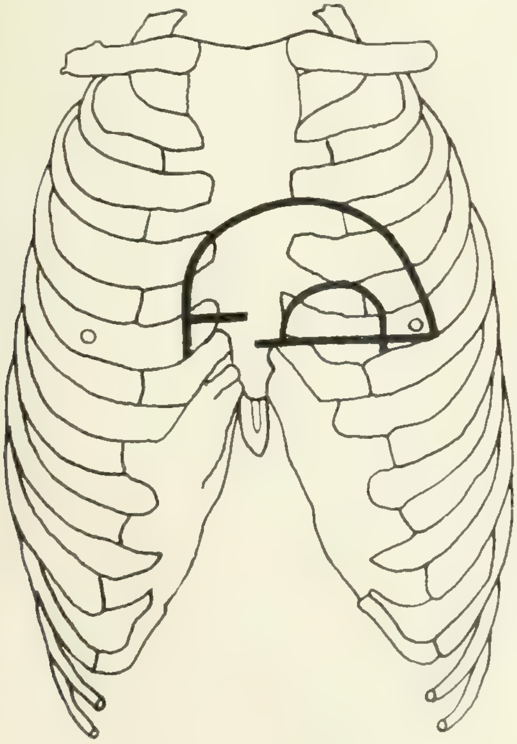


FIG. 3.—Coulbourn. Oct. 13, 1896. Cardiac outline before bath No. 1, strength No. 1. Right border 2¾ cm. from median line. In bath eight minutes.

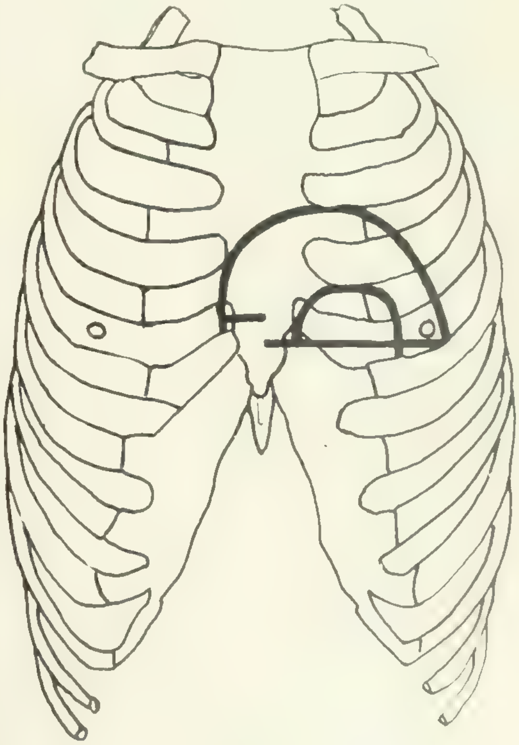


FIG. 4.—Coulbourn. Oct. 18, 1896. Cardiac outline after bath No. 6, strength No. 1. Right border 1½ cm. from median line. In bath eight minutes.

NOTE.—In Figs. 3 and 4 the outline on the right side of the chest extends too far laterally. It did not extend beyond the nipple. There was no change in this line after treatment.

Figs. 3 and 4 illustrate change of 1¾ cm. in cardiac area after six baths of strength No. 1.

FROM THE "SCHOTT TREATMENT" OF CARDIAC DISEASE," BY C. N. B. CAMAC, M.D., J. A. M. A., [illegible]

THE EFFICIENCY OF THE PERIURETERAL ARTERIAL PLEXUS, AND THE IMPORTANCE OF ITS PRESERVATION IN THE MORE RADICAL OPERATIONS FOR CARCINOMA CERVICIS UTERI.

By John A. Sampson, M. D.,

Resident Gynecologist, The Johns Hopkins Hospital. Instructor in Gynecology, Johns Hopkins University.

A knowledge of the clinical efficiency of the blood-supply of the ureters is most important in all operations involving the ureter, and especially so in the more radical operations for carcinoma cervicis uteri. Clinical experience has taught us that the operative treatment of cancer of the cervix of the uterus has been unsatisfactory, for only about 12 per cent of the cases operated upon in this hospital are free from recurrence at the end of 5 years. (Statistics taken in October, 1902.) The only hope of bettering these statistics is by operating on the cases earlier, and doing the most radical operation possible in so-called favorable cases, for in these there is the best chance for a cure. The question arises: what is the most radical operation that can be done without too great a primary mortality? A study of the parametrium in those cases in which the more radical operation has been done shows that it is necessary to remove as much of the parametrium as possible, and that it is very difficult to diagnose clinically the presence of carcinoma in the parametrium, for the growth may metastasize to very small parametrial lymph-nodes, which may not have a diameter of over 1 to 1.5 mm., and cannot be palpated even after the specimen has been removed. From a study of the pathological findings, the indications of the operation which was described by me [1] over a year ago are only too evident. This operation consists in the removal of the lymphatics from the sides of the pelvis and with them the uterus and growth, en masse, and all the tissue from pelvic wall to pelvic wall. The question arises: What should be done with the lower ends of the ureters? If the lower 3-4 cm. of the ureters are removed with the growth and the renal ends of the ureters are implanted in the bladder there is danger of an ascending renal infection, for cystitis is an only too frequent sequel of such an operation. On the other hand, if the pelvic portion of the ureters are dissected free, ureteral necrosis may occur and at the same time the tissue has not been removed intact. I have done 11 of the more radical operations for carcinoma of the uterus, resecting one or both ureters in 3 cases. Three of the 11 cases have died, one on the 5th day from intestinal obstruction, and two from ascending renal infection, one dying on the 9th day and the other on the 17th day. In these last two cases the ureters were resected in one and not in the other. In the eight cases in which the ureters were not resected, they were dissected free as two cords and all the tissue from pelvic wall to pelvic wall was removed. Of these cases, one died of ascending renal infection, and ureteral necrosis occurred in one of the remaining 7 cases. These cases demand a better knowledge of the anatomy and physiology of the ureters and bladder and the etiological factors in the causation of cystitis, ascending renal infection and necrosis of the ureters. I have studied the etiological factors in the causation of renal infection and have published the results of these studies. In this article [2] attention was called to the importance of lowered local resistance and to the fact that injury to the kidney was a most important accessory etiological factor, and also that a stricture of the ureter was probably the most frequent cause of the lowered renal resistance. As cystitis occurs so frequently in these operations and as the ureter is implanted in a bladder which is very apt to become infected, the kidneys are not as well protected when the ureter is implanted as when it has its natural ureteral orifice. Nevertheless, as I shall try to show in this and subsequent articles, the advantages of the resected over the bared ureter are many, and as apparently the cystitis may be controlled by making a vesico-vaginal fistula, future clinical experience may decide in favor of the resection of the ureters. In eleven cases in which I have followed the bladder conditions after these operations, both by cystoscopic examination and by taking cultures, a marked cystitis has occurred in seven cases, in two of which it resulted in renal infection and death. In four cases the bladder appeared normal on cystoscopic examination, and yet in two of them when cultures were taken the colon bacillus was found present. An accidental vesico-vaginal fistula existed in three of these four cases and apparently controlled the bladder infection in these three cases.

The clinical efficiency of the blood-supply of the ureters must be understood whether one shall resect the ureters or dissect them free in these operations. Such knowledge can only be gained by a study of the blood-supply of the ureter, combined with animal experimentation and clinical experience.

THE BLOOD-SUPPLY OF THE URETER.

In reading over the descriptions of the blood-supply of the ureter, which may be found in the various Anatomies and other works dealing with the surgery of the ureter, one is impressed with the meagre account usually given, and the great variability of its source, for it is seldom that any two authors will agree, and furthermore very little seems to be known in regard to the efficiency of the blood-supply. This latter point is of the greatest surgical importance.

Quain [3] makes the following statement in regard to the blood-supply of the ureter: "The ureter is supplied with blood from small branches of the renal, the spermatic, the internal iliac, and the inferior vesical arteries. The veins end in various neighboring veins."

Morris[4] treats the subject a little more fully: "The arteries which supply the ureter are branches of the renal, the spermatic or ovarian, and the vesical; they anastomose freely together in the walls of the ureter, and the blood is returned by corresponding veins." In this manner one will usually find the blood-supply of the ureter disposed of in most of the Anatomies and in the surgical works on the ureter.

The best description of the blood-supply of the ureter which I have been able to find has been given by Disse.[5] According to him the arteries supplying the ureter come from many sources. The pelvis of the kidney is supplied by a branch from the renal artery which extends down over the abdominal portion of the ureter. The spermatic artery also furnishes a branch to the abdominal portion of the ureter as it crosses the ureter. The pelvic portion of the ureter is supplied by branches from the middle hemorrhoidal and inferior vesical arteries. These main arteries run along the ureter and are attached to its wall by loose connective tissue. The large arterial branches, visible to the naked eye, lie in the adventitia of the ureter and run in a longitudinal direction in such a manner that the ureter is encompassed by these vessels. From these larger vessels, branches arise at short intervals, which pierce the muscular coats of the ureter and extend to the propria; here they divide and give rise to small branches extending in a longitudinal direction from the bladder to the kidney. These small arteries are separated from the larger branches of the adventitia by means of the muscular coat. From the small arteries of the propria, capillary systems extend in two directions, one to the epithelium, and the other to form a capillary network inside of the muscular layer. The veins begin within the propria and receive the blood from the capillary network within this membrane. From these small veins, relatively larger vessels are formed which give rise to a venous plexus situated inside of the muscular layer. The main branches of this plexus lie principally in a longitudinal direction and are united together by other vessels. This is called the venous plexus of the mucosa. From this plexus the blood empties into still wider venous branches which lie in the adventitia, alongside of the main arterial trunks.

During the last year I made several experiments in order to determine the efficiency of the blood-supply of the ureter in human beings and the part played by each ureteral artery in nourishing the ureter. In five instances the arteries of the ureter for its entire length were injected by inserting a canula into the renal artery through the incised aorta, using an aqueous solution of Prussian blue in two cases and a 15 per cent solution of gelatine colored with ultra-marine blue in the other three. See Figs. I, II and III. In another instance the internal iliac artery was injected with a 15 per cent solution of gelatine colored with ultra-marine blue, and as a result the arteries of the ureter were injected for its entire length, and, on opening the kidney, a few small vessels in the kidney substance were found to be filled with the blue mass. Fig. V was drawn from this specimen. I have injected the internal iliac artery in another case, the ovarian in one, and the abdominal aorta in two, first clamping the renal and iliac arteries in the latter two cases, so that the coloring material could not enter these vessels. This latter group of cases was not quite as satisfactory as the first six cases referred to, as the work was done after the organs had been removed; nevertheless, they all demonstrated the free anastomosis of the arteries of the ureter giving rise to a periureteral arterial plexus and also that probably one could inject the entire plexus through any ureteral artery if the plexus were intact. Through this plexus there is established an arterial communication between the kidney and the bladder.

The periureteral arterial plexus from which the ureter is nourished is formed as follows: Branches, which we may call uretero-subperitoneal arteries, arise from the larger vessels, as the aorta, the renal, ovarian, iliac, uterine, etc., arteries. The source of these branches varies in different cases. See Figs. I, II, III and IV. These uretero-subperitoneal arteries usually divide into two branches, first a ureteral branch which helps to form the periureteral arterial plexus; second, a subperitoneal branch, which supplies the tissue about or near the ureter. The ureteral arteries on reaching the ureter divide into ascending and descending branches both running along the ureter, and united to it by loose fibrous tissue; the ascending branches anastomose freely with the descending branches of the ureteral artery above, and the descending with the ascending branches of a lower ureteral artery; thus there arise about the ureter, relatively large arterial trunks, running in a longitudinal direction from the kidney to the bladder. From these large trunks smaller branches arise which are more deeply imbedded in the perimuscular fibrous tissue of the ureter than the larger branches, and some of these anastomose with each other, thus forming, with the main trunks, a peri-ureteral arterial plexus extending the entire length of the ureter, up over the pelvis of the kidney and accompanying the ureter through the bladder. From this plexus, still smaller vessels arise which penetrate the walls of the ureter. In addition small twigs may arise from the plexus which leave the ureter to supply the tissue about it (Br. P. Fig. I), and these twigs may anastomose with branches of other vessels supplying these parts (Anas. Br. P. Fig. I).

The subperitoneal divisions of the uretero-subperitoneal vessels supply the tissue about the ureter and also, in places, the peritoneum. These vessels may anastomose with each other and with branches from neighboring vessels, including branches from the ureteral plexus, and thus may serve as a means of nourishing the ureter. The ureter may indirectly receive additional nourishment from other anastomoses, as the uterine and vesical arteries of one side anastomose with those of the other, and in addition there is a free anastomosis between the uterine and ovarian arteries and the branches from the latter anastomose with branches from the renal. The periureteral arterial plexus thus receives its blood-supply from definite ureteral arteries and may be nourished indirectly through the anastomosis of these arteries and branches from the plexus itself with the branches of vessels supplying the tissue about the ureter.

It is easy to demonstrate the anastomoses of the vessels in the outer fibrous coat of the ureter. A very important question associated with the efficiency of the blood-supply of the ureter is to know whether or not there is a free anastomosis between the branches of the deeper ureteral arteries. In sections cut from specimens injected with Prussian blue the free anastomosis of the capillaries can be very easily demonstrated. On the other hand, I have never been able to demonstrate whether or not there was any anastomosis between the small arteries found within the muscular coats. These vessels are not very numerous and are very small, as is shown in Fig. V, where the internal iliac artery was injected with a 15 per cent solution of gelatine colored with ultra-marine blue. Ultra-marine blue being granular, only the arteries are injected, the granules being too large to pass into or through the capillaries.

From a knowledge of the blood-supply of the ureter it would seem that many liberties could be taken with the ureter without causing necrosis. As, for instance, the ureter could be dissected free from the bladder to the kidney, severing all vessels coming to the ureter between those organs, and yet necrosis would not occur if the periureteral arterial plexus was intact. Also in instances where the arteries supplying the ureter were tied, the anastomosis of branches from the plexus with the branches of neighboring vessels as well as the other arterial anastomoses which I have mentioned, would aid in maintaining the nourishment of the ureter. On the other hand, one would suppose that the destruction of the periureteral arterial plexus for only a short distance would lead to necrosis of the ureter, for even if there should be a free anastomosis of the deep arteries of the ureter, on account of their size and small numbers, one would not suppose that they would be capable of maintaining the nourishment of the ureter for any great distance. One must resort to animal experimentation as well as clinical experience in order to fully determine the efficiency of the blood-supply of the ureter.

Experiments on Dogs, Demonstrating the Efficiency of the Blood-Supply of the Ureter.

The blood-supply of the ureter of the dog has been studied by several investigators. Margaroucci[6] thought that the principal source was derived from two small branches of the renal artery which accompanied the ureter as far as its opening into the bladder. Monari[7] has made some very interesting experiments in regard to the efficiency of the blood-supply of the ureter in dogs. He calls attention to the fact that the vessels supplying the dog's ureter run, in the perimuscular connective tissue, parallel to the ureter and are united to each other by numerous branches. He states that the ureter should not become necrotic when it is isolated for its entire length. He showed that the ureter of a dog could not only be freed for its entire length, but could also be free from the connective tissue surrounding it for a distance of 12-13 cm., and if replaced in this tissue necrosis could not occur. On the other hand, when he isolated the ureter for a distance of 6 cm. and placed gauze about it, necrosis occurred. Protopopow[8] has written a very extensive article on the anatomy and physiology of the ureter, in which he describes the blood-supply of the dog's ureter, calling attention to the free anastomosis of the vessels in its outer coat, thus demonstrating an arterial anastomosis between the bladder and the kidney. He states that he does not know if such a condition exists in human beings.

I have made several experiments in order to determine the efficiency of the blood-supply of the ureter in dogs. There is an arterial plexus about the ureter of a dog very similar to that found in man. It receives branches from the vessels near it and presents variations much as are found in human beings. The main trunks of this plexus tend to arrange themselves in two relatively large branches, one on each side of the ureter, which are loosely bound to the ureter. The smaller branches arising from these trunks anastomose with each other, thus forming the meshwork of the plexus, and are more closely united to the ureter than the larger vessels, as is also the case in man. On this account it is quite easy to injure the large trunks but not the smaller branches.

I. In seven dogs, the ureter was isolated for its entire length and an attempt was made to strip off the periureteral arterial plexus with my finger-nails. The dogs were killed in from 1 to 4 weeks and ureteral necrosis occurred in only two cases. In 5 cases the descending aorta was injected with a 15 per cent gelatine colored with ultra-marine blue, and very satisfactory injections of the ureter were obtained. It could be seen in these specimens that in trying to strip off the arterial plexus, I had removed only portions of the main arterial trunks and the large veins, while most of the smaller branches, which are imbedded more deeply in the outer coat of the ureter and form the meshwork of the plexus, were uninjured and were able, in five instances, to maintain the arterial plexus, and thus the blood-supply of the ureter.

II. In three dogs the ureter was isolated for about 4 cm. and in order to completely destroy the plexus, the ureter was scraped on all sides with a very sharp knife for a distance of 2 cm. Necrosis occurred in each instance.

III. In three dogs a ureter was isolated for nearly its entire length and then the larger vessels of the plexus were torn off by the finger-nails and mouse-tooth forceps, as in the first experiments. Both uterine vessels were tied, thus ligating the ureteral artery which completes the lower end of the plexus and arises from the uterine. Necrosis occurred in each instance.

IV. An attempt was made to simulate the condition sometimes found after the more radical operations for cancer of the uterus. In eight dogs the ureter was isolated for about its lower one-third and the tissue about it, including portions of the larger vessels of the plexus, were torn off as above. Both uterine arteries were tied and necrosis occurred in seven of the eight cases.

V. In two dogs the above was done, except the uterine artery on only one side was tied. Necrosis occurred in one case.

VI. In 25 uretero-vesical implantations in dogs, there was but one failure and that occurred in one of nine cases where organisms had been introduced into the bladder, in order to see the results of implanting the ureter in the presence of infection. In three of these nine cases the kidney became infected, and in each instance there was quite a marked stricture of the ureter at the seat of the implantation.

VII. In another dog the ureter was freed and stripped, as in previous operations. A small rubber tube, 8 cm. long, was split, and, by springing it apart, the ureter was placed within its lumen. Necrosis of the ureter occurred for a length of 7.5 cm.

It is evident that in a dog the ureter may not only be freed for its entire length, but its larger vessels may in part be destroyed by stripping them off, yet necrosis will not necessarily occur, for the plexus may be maintained by the smaller branches which are more adherent to the ureter and are very difficult to remove, and also by such portions of the larger trunks which have not been destroyed. On the other hand, when the ureter is scraped with a sharp knife, thus destroying the smaller branches as well as the larger, then necrosis will occur, even though the distance be very short. Again, when the ureter is freed but a short distance and the plexus interfered with, and in addition the arteries supplying the lower end of the ureter are ligated, then necrosis is very apt to occur; for the portion of the ureter stripped and also that below the injury, must receive most of its blood-supply from the blood-vessels in the plexus above the injury, and the stripping may interfere with the blood reaching these parts through the injury to the plexus.

In injury to the ureteral plexus, veins are destroyed as well as arteries, but as there is a very free anastomosis between the veins of the ureter, one would expect much less trouble from injury to the vein. Nevertheless, it must embarrass the circulation to a degree, varying with the extent of the injury.

Infection, exudates and foreign material, as gauze, must all be considered as accessory etiological factors in the causation of ureteral necrosis.

So far, the results of the study of the blood-supply of the ureter in man and experiments on animals tally. The next question which must be considered is what may be learned from clinical experience.

Clinical Cases showing the Efficiency of the Blood-Supply of the Ureter.

The clinical efficiency of the blood-supply of the ureter has been demonstrated by many operators.

In 1893, Kelly,[9] in attempting to remove the uterus in an advanced case of carcinoma of the cervix, ligated both internal iliac and ovarian arteries. The growth was not all removed and ureteral necrosis did not occur, although the left ureter was imbedded in cancerous tissue and was dissected free.

In 1896, Pryor[10] advocated the ligation of both internal iliacs in advanced cases of cancer of the uterus with the view of starving the growth. He refers to instances where these vessels have been ligated for other purposes and the pelvic organs have not been injured by the procedure. The following year he[11] reported a case where he ligated both internal iliac arteries for post-operative recurrence of carcinoma cervicis uteri in the vaginal vault. Necrosis of the pelvic organs did not occur.

Krönig[12] has reported three cases of extensive carcinoma of the cervix of the uterus, where he had ligated both internal iliac and ovarian arteries with satisfactory palliative results.

Iwanow[13] has reported five cases of inoperable carcinoma cervicis uteri where he had ligated the round ligament, the ovarian and internal iliac arteries with results similar to Krönig's cases.

From a review of such cases reported in the literature it becomes evident that the simultaneous ligation of the internal iliac, ovarian arteries and round ligament does not lead to necrosis of the ureters; for, as would be inferred from a study of the blood-supply of the ureter, as long as the arterial plexus is intact, necrosis would not occur. In addition, the other pelvic organs where the blood-supply has been injured by the ligation of these large vessels, would receive nourishment through the ureteral plexus, for by means of a canula inserted in the renal artery alone, one may not only inject the entire ureter, but also the uterus and bladder will be found to be partially injected. See Figs. II and III.

Cases may be found in the literature where the ureter has been freed for a long distance and yet ureteral necrosis apparently has not occurred.

Sänger[14] reports two such cases where the ureter was dissected free, in the removal of two intraligamentary cysts, without any apparent injury to the ureter.

Chrobak,[15] in the removal of an intraligamentary myoma, isolated the ureter for a distance of 8 cm. and at the close of the operation sutured the peritoneum over it and the patient recovered without any symptoms referable to the injury.

Rühl,[16] during a hystero-myomectomy, found that the ureter passed through an intraligamentary myomatous nodule for a distance of 7 cm. The ureter was dissected free and the convalescence was uneventful.

In 1894, Durante[17] removed a large adeno-cystoma of the ovary which was intraligamentary and had pushed the organs from the wall of the pelvis, including the left ureter, which was dilated to a diameter of 17-18 mm. It was found necessary to free the ureter from the kidney to the bladder. At the close of the operation the ureter fell back into the abdominal cavity like a loose cord. The convalescence was uneventful.

Frequently in this hospital the ureter has been exposed for long distances in the removal of intraligamentary cysts and myomata, and yet in not a single instance has necrosis followed such a procedure in these cases.

One realizes that when both internal iliac arteries are ligated, as in the cases above referred to, the arteries supplying the pelvic portion of the periureteral arterial plexus are destroyed, but necrosis does not occur, for the plexus is intact, and if so, it could probably be supplied by the renal artery alone. On the other hand, when the ureter is dissected free, there is danger of injuring this plexus. Yet one realizes that still necrosis may not occur, for the plexus may not be injured, or such injury as may occur may be compensated by the smaller vessels of the plexus. Operators, both in this country and abroad, frequently ligate both internal iliac vessels and dissect the ureters free in hysterectomy for cancer of the uterus, and yet necrosis does not necessarily occur. On the other hand, necrosis of the ureters does sometimes occur in the more extensive operations for cancer of the uterus.

Clinical Cases Showing that Necrosis of the Ureters May Occur.

There have been six instances of ureteral necrosis in 156 hysterectomies for cancer of the uterus in this hospital, and in each instance, in addition to ligating the uterine or anterior branch of the internal iliac artery or the internal iliac artery itself, the ureter has been exposed and dissected free. These procedures would not only probably cut off all vessels supplying the lower portion of the ureter, but by dissecting the ureter free the periureteral arterial plexus was also injured, thus interfering with the blood-supply coming from above. These cases will be reported in full in a subsequent article on ureteral necrosis.

Instances of ureteral necrosis following hysterectomy for cancer of the uterus may be found reported by several writers. Of interest are the cases of Wertheim.[18] He had five cases of post-operative ureteral fistula in his second series of thirty cases of hysterectomy for carcinoma cervicis uteri. Three of these cases were double, making in all eight instances. His operation consisted, first, in the isolation of the pelvic portion of the ureters from a point above their entrance into the parametrium down to the bladder. Thus the ureters were out of harm's way and a wide dissection of the parametrium was possible. The uterine arteries were ligated where they crossed the ureter.

At the instigation of Wertheim, Feitel[19] studied the blood-supply of the ureter in infants, especially as related to the operation of hysterectomy for carcinoma of the cervix. Feitel showed that the upper part of the pelvic portion of the ureter receives its blood-supply from the mesial side, i. e., from the aorta, the common and internal iliac vessels, and the lower portion receives its blood-supply from vessels lateral to the ureter, i. e., the uterine and vesical arteries. When it is necessary to expose the ureter, he advises that the upper part of the pelvic portion should be exposed by opening the peritoneum lateral to it, carrying the incision across the ureter, at the middle of the pelvic portion, and continuing down along the lower pelvic portion of the ureter mesial to it. Thus the nutrient vessels will not be injured. Wertheim,[20] in his next thirty cases, followed the suggestion of Feitel and did not dissect the ureter free as in the previous cases, but carried his dissection down mesial to the ureter, i. e., between the cervix and the ureter, in order to avoid vessels coming to the lateral side of the ureter. As a result of this procedure there were only two ureteral fistulæ in the thirty cases, as compared with eight in the previous thirty cases; and in these instances in which necrosis occurred the fistula resulted from *dissecting free the ureters, which were adherent to the growth, and thus he injured the periureteral arterial plexus.*

The Relation between the Ureters and Carcinoma Cervicis Uteri.

In order to understand the difficulties in freeing the ureters in hysterectomy, one must undertand the anatomical relation between the ureters and the cervix of the uterus. If one will examine the ureters at autopsy, a very good idea may be obtained of certain anatomical features which are of the greatest importance in all operations involving the lower end of the ureters.

If the abdominal portion of the ureter is exposed and partially freed, and traction is made upon it, it can be drawn out from what is apparently a sheath, which seems to be derived from the subperitoneal connective tissue and is continuous with that surrounding the kidney above and accompanies the ureter into the pelvis below. Cross-sections of the abdominal portion of the ureter do not bring this out very clearly and it requires some play of the imagination to make out a definite sheath about this portion of the ureter. If the dissection is carried down into the pelvis, this apparent ureteral sheath becomes more definite, and cross-sections of this portion of the ureter show a definite sheath about the ureter which seems to be but a thickening of the pelvic tissue through which the ureter plays and is apparently continuous with the subperitoneal connective tissue about the abdominal portion of the ureter. In Fig. V, which represents a cross-section of the ureter taken about 1.5 cm. above the uterus, one can see the definite ureteral sheath and how it is apparently derived from the tissue about the ureter and acts as a protection to the ureter and the periureteral arterial plexus. If the dissection is carried on down to the bladder, the lower portion of the ureter will be found to be reinforced by muscular bundles which apparently extend up from the bladder over the ureter.

Waldeyer[21] has called attention to the fact that there is pictured in Krause's anatomy, longitudinal muscular bundles which extend from the bladder up to the ureter, but the cut is not accompanied with any description. Waldeyer describes them as longitudinal muscular bundles, which are united to each other by connective tissue and separated from the ureter by a space which can be injected. This sheath has a thickness of .5 to .75 mm., and he says extends 3-4 cm. up in the ureter. The lumen he considers to be a lymph-space.

Disse[22] refers to Waldeyer's sheath and says that these muscular bundles which are greatly hypertrophied, do not arise from the bladder as they appear to do, but from the ureter, and suggests that their hypertrophied condition as well as the space between them and the ureter arises from the contractions of the bladder pulling on the outer ureteral coat.

There are present about the pelvic portion of the ureter possibly two sheaths instead of one, the so-called sheath of Waldeyer, which Disse claims arises from a hypertrophy and splitting of the outer ureteral muscular coat, and the second sheath, which apparently encircles the upper portion of the former sheath, blending with it, and extending upwards along the ureter. Further studies may show that this second sheath is but a continuation of the other, but from the few cases I have studied, it would seem to be different in origin, and although it blends with the other, it encircles the upper end of it, and extends further up along the ureter. The relation between the two sheaths needs further investigation. This latter sheath apparently arises from the tissues about the pelvic portion of the ureter and is continuous with the subperitoneal tissue surrounding the abdominal portion of the ureter. This sheath, which may be called the pelvic or ureteral sheath, is composed of fibrous tissue with an occasional muscle-bundle. Its lumen is, for the most part, filled with adipose tissue and fine fibrous tissue strands, thus acting as a cushion surrounding the ureter. One finds in the hardened specimens empty spaces which may be lymph-spaces, or possibly artefacts. This sheath is of great importance, for it not only furnishes a channel in which the ureter may slide as it contracts, but is also a protection to the ureter from the invasion of cancerous growths or inflammatory processes, and during operations in that portion of the pelvis. Of special interest in connection with this work is the fact that the periureteral arterial plexus lies within this sheath and is thus protected by it. See Figs. V and VI.

If one will study serial sections of the parametrium, one can see how adherent this ureteral sheath may be to the other structures in that part of the pelvis, especially the utero-vaginal and vesico-vaginal plexuses of veins, for it is from these structures that it is apparently partially derived. It is evident that the isolation of this sheath in the parametrial portion of the ureter is very difficult on account of its association with the structures above referred to, much more so than in that portion of the ureter above the parametrium, for here it lies just beneath the peritoneum and by freeing the peritoneum the ureter with its sheath may be moved about on the peritoneal flap. When the ureter is bared in these more radical operations, it is dissected out from this sheath and lies as a loose cord in the pelvis and there is the liability not only of necrosis from injury to the plexus, but the ureter has been deprived of its sheath and must now become fixed in scar-tissue, and thus its function will be interfered with and there is the opportunity for ureteral adhesions and partial or complete ureteral obstruction; and we realize how important an accessory etiological factor stricture of the ureter is, in the causation of renal infection. These statements have been confirmed by experiments on dogs and also, in one instance, where I made a uretero-vesical implantation for necrosis of the ureter, I found the ureter imbedded in dense scar-tissue.

What shall be done in hysterectomy for cancer of the uterus? Feitel and Wertheim solved the problem as far as the prevention of ureteral necrosis is concerned. When Wertheim removed the parametrium mesial to the ureter in order not "to injure the vessels supplying that portion of the ureter which comes in lateral to the ureter," he did something of still greater importance as far as the blood-supply of the ureter is concerned, viz.: that the ureter with its periureteral arterial plexus, as well as its sheath, is probably not injured. As stated, Wertheim did this in 30 cases and necrosis resulted in only two and in these the growth had extended out to the ureters, making it necessary to bare the ureters and thus the sheath was not only destroyed but the plexus was probably injured sufficiently, to cause necrosis of the ureters. We realize that when the parametrium is involved either by a direct extension of the growth or by metastases, it takes but very little involvement to go to or beyond the ureters, as I shall show in a subsequent article; therefore, when Wertheim did a hysterectomy mesial to the ureters and also removed the pelvic lymph-nodes, the intermediate tissue between the primary growth and the pelvic lymph-nodes about or lateral to the ureter had been left behind.

If one were sure of the prevention of ascending renal infection, the resection of the ureters would be the most rational procedure, for the ureters could be cut off just as they enter the parametrium 1.5 cm. below the place from which illustration, No. V, was made and afterwards the peritoneal flap carrying the ureter with its sheath could be carried down to the bladder, and after implanting the ureter into the bladder, the sheath with the peritoneal flap could be sutured to the bladder, and thus the plexus would be uninjured and the ureter would be provided with a sheath which could help to prevent stricture and protect the blood-supply of the ureter. In addition, all tissue from pelvic wall to pelvic wall could have been removed and with it the early extension and metastasis of the growth into the parametrium. Some may claim that when the parametrium is involved either by direct extension or by metastasis, the case is hopeless. If so, the vaginal operation is the one of choice in all cases. This statement needs confirmation, and it is too early to make any definite statements either way, and the more radical operation is demanded on the basis of the pathological findings and the results of the less radical operations. If the cystitis and ascending renal infection can be controlled by making a vesico-vaginal fistula and if the implantation can be made without too much tension, thus avoiding a stricture, then this is the operation of choice, for it offers the greatest chance for a cure. The suturing of the ureteral sheath and the peritoneum to the bladder will undoubtedly in great measure relieve the tension of the implantation.

The dissecting free of the ureters is difficult, more so than resecting them. While there is less danger of ascending renal infection there is a greater chance of ureteral necrosis. A hysterectomy mesial to the ureters offers less chance of a cure than the above and also little danger of either ascending renal infection or ureteral necrosis.

CONCLUSIONS.

1. The ureter is nourished by a periureteral arterial plexus, the main trunks of which run in a longitudinal direction, from the kidney to the bladder, in the outer loose perimuscular

fibrous coats of the ureter. From these longitudinal vessels, smaller branches arise, some of which anastomose freely with each other, thus forming the mesh-work of the plexus. These smaller branches are for the most part more deeply imbedded in the outer coat of the ureter than the main trunks, which in places may be but loosely united to the ureter.

2. This plexus is nourished mainly by the ureteral arteries which arise from branches of large vessels along the course of the ureter, as, the aorta, the renal, ovarian, iliac, uterine, and other arteries. The ureteral vessels are not the same in all cases, as a branch from one artery, as for instance, the ovarian, present in one case may be absent in another and its place taken by a branch from another artery, as the aorta, a ureteral branch of which may not be present in the first case. See Figs. I, II, III, and IV.

3. The plexus may receive additional nourishment from small branches arising from the plexus, which supply the tissue about the ureter and may also anastomose with the branches of other vessels supplying these parts.

4. It is possible to inject the entire plexus from such arteries as the renal and internal iliac, and also probably from any one artery which furnishes a ureteral artery.

5. The ureter with its plexus is protected by the tissue in which it lies, and in the pelvis this tissue is converted into a definite sheath, which is apparently derived from the tissue through or along which the ureter passes. This sheath acts as a protection to the ureter and its plexus from the invasion of cancerous growths and inflammatory processes, and should be recognized in all operations involving the pelvic portion of the ureter.

6. Animal experimentation shows that many liberties may be taken with the ureter and even when the plexus is injured that the blood-supply of the ureter may be maintained by the smaller branches of the plexus which are more deeply embedded in the outer coat of the ureter than the larger vessels, and so are more difficult to injure. The ureter of a dog may not only be dissected free for its entire length, but even the plexus may be injured and yet necrosis may not occur. On the other hand, the complete destruction of the plexus for only a short distance, or the partial destruction of the same, which ordinarily would not cause necrosis if combined with the ligation of the vessels supplying the vesical end of the plexus, is apt to cause necrosis.

7. Clinical experience confirms the results of anatomical studies and animal experimentation and shows that while many liberties may be taken with the ureter, the plexus should be guarded in all operations involving the ureter. The ureter has been freed for its entire length and yet necrosis has not occurred. Both internal iliac, the ovarian and the vessels of the round ligament have been tied with similar results. On the other hand, when the ureter is dissected free from some adherent mass, even for a short distance, as, for instance, from a carcinomatous cervix of the uterus, there is danger of necrosis, for the larger vessels of the plexus may not alone be destroyed, but also the smaller branches which are more intimately united to the ureter. In operations for cancer of the cervix this danger is increased where vessels supplying this portion of the ureter are ligated, as, the uterine, anterior branch of the internal iliac or the internal iliac artery. I cannot see that there is any operative advantage to be gained in ligating either the internal iliac or its anterior branch, over the ligation of the uterine alone, and there is this disadvantage that the chance of ureteral necrosis is not only increased but there is danger of lowered local resistance for the portion of the pelvis supplied by these vessels which would predispose these parts to infection.

8. Other accessory etiological factors must be considered in the causation of ureteral necrosis; as, infection, exudates, destruction of tissue about the ureter as would result from the use of a cautery, foreign bodies against the ureter (as gauze), pressure on the ureter, stricture of the ureter, and lowered general resistance. In addition, injury to the ureteral veins, although there is a free anastomosis between the veins in the wall of the ureter, must embarrass the ureteral circulation to a degree varying with the extent of the injury and so would interfere with the nutrition of the ureter.

9. Hysterectomy in carcinoma cervicis uteri, where the parametrium is removed mesial to the ureter, must leave cancer either in the form of metastases or as an extension of the growth into the parametrium in many cases. On the other hand, the chance for ureteral necrosis is slight, for the ureteral plexus surrounded by the pelvic ureteral sheath is uninjured.

10. The more radical operation with dissecting the ureter from its sheath offers a greater chance for cure than the above, but there is the danger of ureteral necrosis, for by freeing the ureter the vessels supplying that portion of the plexus are destroyed and the lower 3-4 cm. thus freed must be nourished by blood coming from the upper portion of the ureter through the periureteral plexus, and unless great care is taken this may be injured sufficiently to cause ureteral necrosis.

In addition, the ureteral sheath has been destroyed and that portion of the ureter becomes imbedded in scar-tissue, and its function is impaired with the danger of partial or complete ureteral obstruction, with the accompanying lowered renal resistance and liability to renal infection.

11. Resection of the lower 3-4 cm. of the ureters and the implantation of the renal end of the ureters into the bladder offers the greatest chance for a cure, and at the same time there should be less chance for ureteral necrosis, for the ureter above the parametrium can be brought down to the bladder with its plexus intact, surrounded by the pelvic ureteral sheath, and after implanting the ureter into the bladder its sheath may be sewed to the bladder and also the peritoneal flap in which this portion of the ureter with its sheath lies. The drawback to this procedure is the possibility of renal infection and stricture of the ureter from implanting the ureters under tension. The renal infection may possibly be controlled by the formation of a vesico-vaginal fistula and the freeing of the bladder and suturing the pelvic ureteral sheath with the peritoneal flap to the bladder should relieve the tension of the implantation.

12. Whichever course is followed in these operations, from the basis of anatomical studies and confirmed by animal experimentation and clinical experience, *the periureteral arterial plexus and also the ureteral sheath should be preserved.* As stated, this is in a measure met by resecting the lower portion of the ureters and implanting their renal ends into the bladder, as described above. This is the only operation justifiable where the growth has involved the ureteral sheath. On the other hand, in so-called favorable cases, one could free the tissue between the two pelvic walls and instead of resecting the ureters, the ureters with their sheath could be freed from an incision made through the parametrium lateral to the ureters, and thus all the tissue would be removed except the ureters and their sheath, and the dangers of ureteral necrosis and stricture would be reduced to a minimum. This plan looks well on paper, but the sheath is very adherent to the surrounding tissues and a careful dissection would prolong an already exhausting operation; and again, the chances of leaving minute metastases in the pelvis are greater than when the ureter is resected. For only by the use of the microscope can one with surety diagnose the presence of cancer in the parametrium. However, clinical experience alone can decide which method offers the greatest percentage of cures combined with the lowest primary mortality.

I am sure that many of us who are only too well acquainted with the mental and physical torture, the pain, the vesical and rectal fistulæ, etc., so generally associated with the clinical course of cancer of the cervix not operated upon, and the fact that such a large per cent recur after operation, which means that they have not escaped the above mentioned misery, will agree that any operation, no matter how severe, which gives the highest percentage of cures, is the one to be developed, not only in the advanced cases, but *especially in the early ones,* for in these there is the greater chance for a cure.

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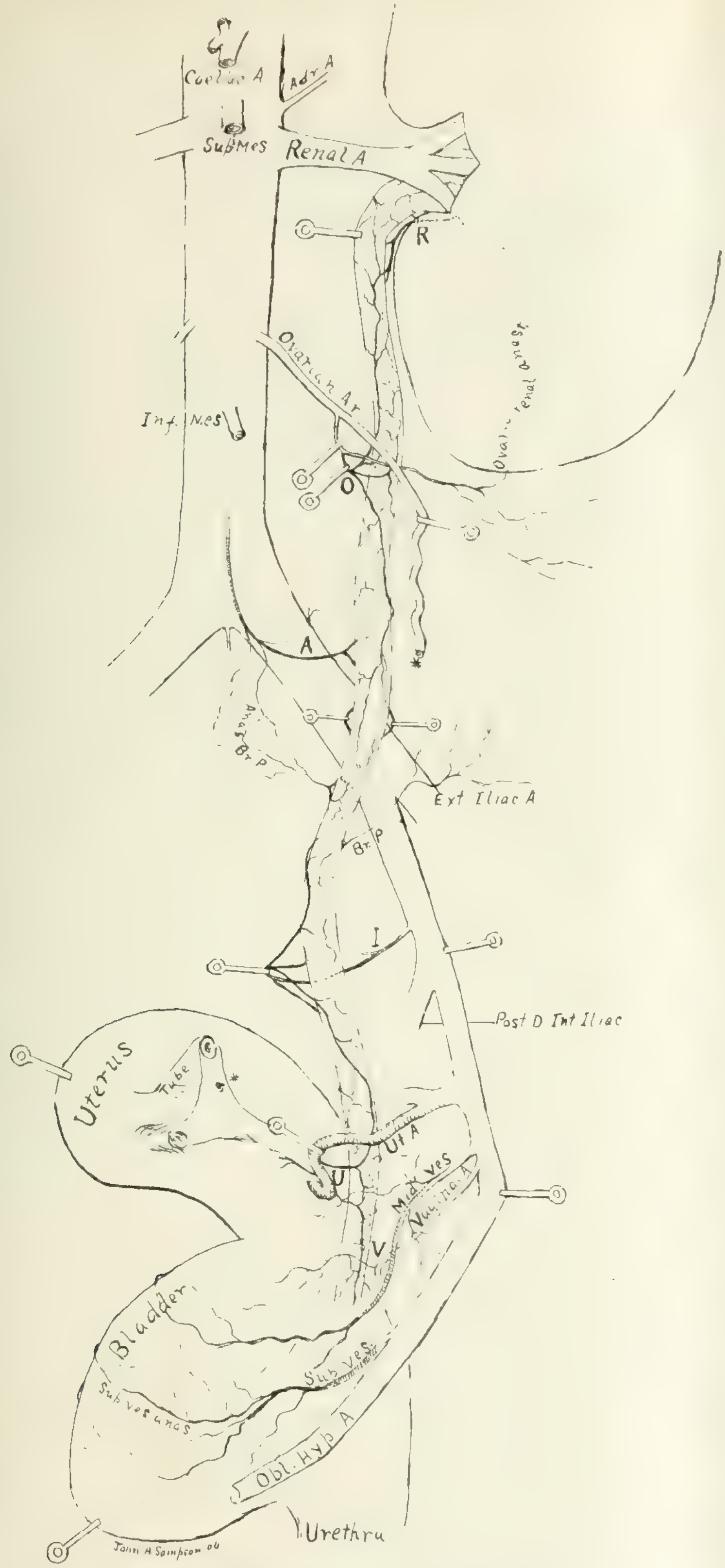
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I
Post D Int Iliac
Uterus
Tube
Ut A
U
Mid Ves
Vaginal A
V
Bladder
Sub ves anas
Sub Ves
Obl. Hyp A
Urethra
John A Sampson 04

FIG. I. THE PERIURETERAL ARTERIAL PLEXUS FROM A WOMAN 21 YEARS OLD, × 4/5. LEFT URETER.

The reft renal and right internal iliac arteries were injected with a 15 per cent solution of gelatine, colored with ultramarine blue. The organs were removed and hardened in 10 per cent formalin. The drawing was made from the dissected hardened specimen.

The periureteral arterial plexus in this instance is derived from branches of the aorta, renal, ovarian, internal iliac, uterine, and vaginal arteries, marked, A, R, O, I, U, and V.

Uterus drawn upwards and to the right, the tube and ovary have been removed.

Contracted bladder, drawn downwards and to the right.

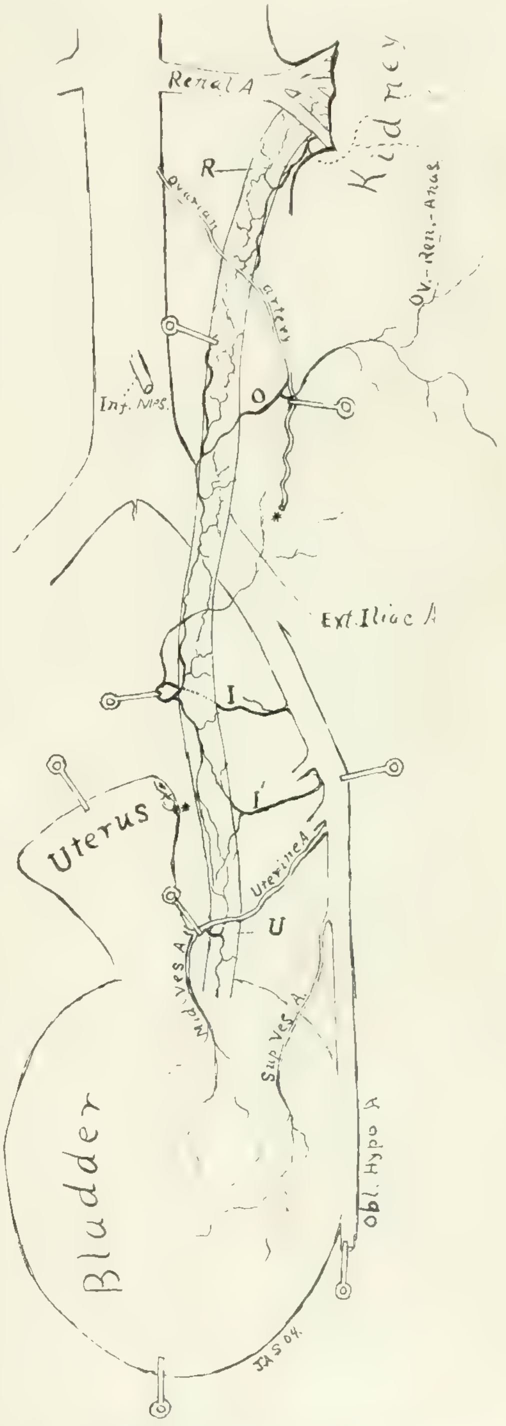
Ovario-Renal Anast. Anastomosis between the subperitoneal branches of the uretero-subperitoneal arteries, arising from the renal and ovarian arteries.

* * Anastomosis between the uterine and ovarian arteries, cut away by the removal of the tube and ovary.

Br. P. Branch from the periureteral arterial plexus, supplying the tissue about the ureter.

Anast. Br. P. Anastomosis between the subperitoneal branch of the aortic uretero-subperitoneal artery, and a branch arising from the plexus.

Sup. Ves. Anast. Anastomosis of the superior vesical artery of one side with the superior vesical artery of the other side.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U
Mid Ves A
Sup Ves A
Bladder
Obl. Hypo A
JAS 04

FIG. II. THE PERIURETERAL ARTERIAL PLEXUS FROM A GIRL 7 YEARS OLD, × 1. LEFT URETER.

The left renal artery was injected with an aqueous solution of Prussian blue. The organs were removed and hardened in 10 per cent formalin. The drawing was made from the dissected hardened specimen.

The origin of the plexus differs slightly from that shown in Fig. I.

The aortic branch is absent, and the branch from the ovarian artery arises from that artery after it has crossed the ureter. There are two branches from the internal iliac artery and one from the uterine.

* * Utero-ovarian anastomosis, cut away by the removal of the tubes and ovaries.

Uterus drawn upwards and slightly to the right.

Distended bladder, drawn downwards.

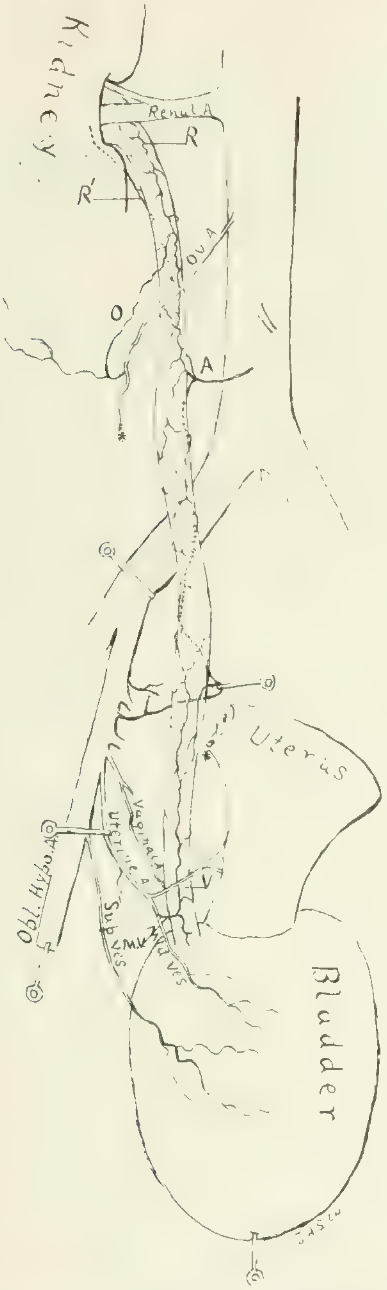

FIG. III.—THE PERIURETERAL ARTERIAL PLEXUS FROM A GIRL 3 YEARS OLD, × 1. RIGHT URETER.

Both renal arteries were injected with a 15 per cent solution of gelatine, colored with ultramarine blue. The organs were removed and hardened in 10 per cent formalin. The drawing was made from the dissected, hardened specimen. This represents another variation in the arteries giving rise to the periureteral arterial plexus. There are two branches, R and R′, from the renal, one from the aorta, A, one from the ovarian, which is recurrent, O, and has the form of an anastomosis of an artery derived from the plexus with a subperitoneal branch of the ovarian artery. The pelvic portion of the plexus is nourished by a branch, I, from the internal iliac, a branch M. V., from the middle vesical, which, in this instance, arises from the uterine also a branch, V, from the vaginal artery, which approaches the ureter from its posterior surface.

* * Utero-ovarian anastomosis.

Uterus drawn upwards and slightly to the left.

Bladder drawn downwards.

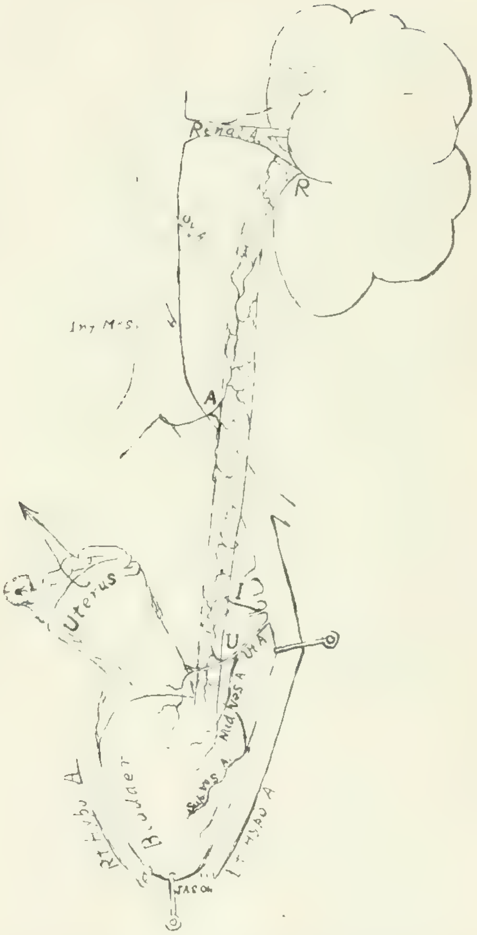

FIG. IV.—THE PERIURETERAL ARTERIAL PLEXUS FROM A NEWBORN GIRL, × 1. LEFT URETER.

The abdominal aorta was injected with an aqueous solution of Prussian blue. The organs were removed and hardened in 10 per cent formalin. The drawing was made from the dissected hardened specimen.

This again represents another variation in the origin of the periureteral arterial plexus. There is one branch, R, from the renal, the ovarian branch is not present, the other branches were derived from the aorta, A, internal iliac, I, and uterine, U, arteries. The uterus is drawn upwards and to the right.

These four illustrations represent four variations in the origin of the periureteral arterial plexus, which might be found in four adult specimens.

Compare the relation in size between the hypogastric artery and its branches in the infant and the adult, and the relatively greater size of the ovarian and uterine arteries in adult woman.

The ureter in this illustration has purposely been drawn, a trifle enlarged.

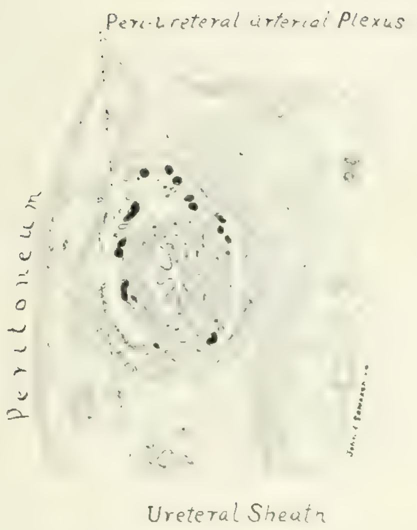

FIG. V.—CROSS SECTION OF URETER SHOWING THE PERIURETERAL ARTERIAL PLEXUS, AND THE URETERAL SHEATH, IN A WOMAN 21 YEARS OLD, × 5. RIGHT URETER.

The left renal and the right internal iliac arteries were injected with a 15 per cent solution of gelatine, colored with ultramarine blue. The organs were removed and hardened in 10 per cent formalin. The drawing was made from a cross section of the right ureter taken about 1.5 cm. above the uterus. Same case as one from which Fig. I was made.

For the sake of clearness only the ureteral arteries are drawn, as injected. The capillaries and the veins were not injected.

The periureteral arterial plexus situated within the ureteral sheath can be seen cut across, as well as small arteries within the ureter. This sheath of fibrous tissue which apparently is derived from the pelvic connective tissue, in this situation is adherent to the peritoneum and in freeing the peritoneum from the wall of the pelvis this portion of the ureteral sheath remains attached to the peritoneal flap thus formed. This sheath serves as a protection to the ureter and its periureteral arterial plexus. See Fig. VI.

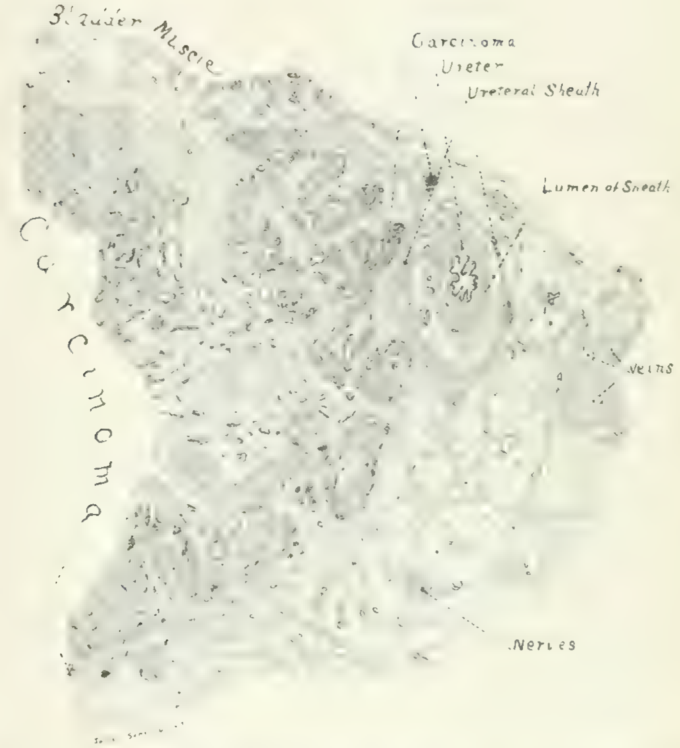

FIG. VI.—RELATION OF CARCINOMA CERVICIS UTERI TO THE URETER.

Transverse section of the parametrium and one-half of the cervix from a specimen of hysterectomy for carcinoma cervicis uteri in which the lower portion of the right ureter was sacrificed and the renal end of the ureter implanted into the bladder, × 2¼. Gyn. No. 10,494. Gyn. Path. No. 7515.

Section, right side, lower third of the parametrium. The carcinoma has extended out into the parametrium and has invaded the ureteral sheath thus causing it to hypertrophy and serve as a protection to the ureter from the growth, and later this progressive hypertrophy of the sheath will compress the ureter giving rise to a stricture and renal insufficiency.

The periureteral arterial plexus can be seen in transverse section, situated about the ureter within the sheath.

One can see that the growth does not have to extend far into the parametrium in order to reach the ureter.

TWO CASES OF LEUKOKERATOSIS BUCCALIS; COMPARISON WITH THE HISTOLOGICAL CHANGES IN A CASE OF TYLOSIS PALMÆ ET PLANTÆ.

By Sylvan Rosenheim, M. D.,

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(From the Clinic of Dr. Mackenzie, Johns Hopkins Hospital.)

Dermatologists have been acquainted with disease of the skin, characterized principally by an increase in the horny layer for a much longer time than with similar disease of the mucous membrane. Consequently it is not surprising that the terms icthyosis (Hulke), tylosis (Hutchinson), keratosis (Kaposi), and psoriasis, applied to the former, have been used to describe the latter, since the clinical picture is so similar. Moreover, the disease was at first described by dermatologists and syphilographers and usually in connection with similar diseases of the skin. Alibert and Plumbe, in a case of icthyosis of the skin, describe similar whitish patches on the tongue.

Among the earliest reports on the disease as an idiopathic affection of the mucous membrane of the mouth are those of Müller in 1851 and Hulke in 1869. The latter described a case of white patches in the tongue as a case of "Icthyosis Glossæ," pointed out the pathological changes and noted the occurrence of epithelioma of the tongue six years after the removal of this patch. Schwimmer proposed the name leukoplakia for the disease. Perhaps leukokeratosis, used by Butlin, is a better descriptive name.

Leukokeratosis consists of more or less diffuse whitish, bluish-white, or pearly-grey colored patches, situated on the tongue or buccal mucous membrane. Schwimmer describes an earlier stage of the disease characterized by reddish areas in the mucous membrane. The duration of this stage is unknown.

We wish to describe a case in which the etiology is distinct, being clearly due to tobacco, another idiopathic case, and compare the histological changes present in these cases to a case of tylosis palmæ et plantæ, which it has been our good fortune to see. We wish to thank Prof. J. W. Lord for his kindness in allowing us to use the notes of this case, which was under his care in the wards of the Johns Hopkins Hospital. The illustrations of the sections are photomicrographs, taken by Dr. Chas. H. Potter, whom we thank heartily for his painstaking efforts in our behalf. Their clearness points out the great development that this branch has taken. It emphasizes the fact that we need no longer depend solely on drawings for illustrations of microscopical studies, which are so much better and accurately shown by photographs.

History of Cases of Leukokeratosis Buccalis.

Case I.—Albert S., white, æt. 52, came to the Johns Hopkins Dispensary complaining of cough and hoarseness.

Family History.—Negative for consumption.

Patient's History.—Denies lues. For the last twenty years the patient has chewed tobacco and has made a practice of holding the quid of tobacco against the inside of the left cheek when not chewing.

Present Illness.—Began with a slight cough in the winter of 1901. Some difficulty in swallowing 6 weeks ago. Caught cold one week ago while in a perspiration.

Physical Examination.—In the left cheek, where the patient has held his tobacco, is an irregular greyish-white patch about the size of a half-dollar, slightly raised above the level of the surrounding mucous membrane. A small piece of this tissue was excised for examination.

The mucous membrane of the nose and pharynx was atrophic. There was a slight injection of the vocal cords and interarytenoid area. The patient was seen some weeks later when the place excised was covered by fine greyish-white plaques like the rest of the patch.

The tissue was fixed in formalin and sections stained with thionin, Van Gieson's stain and hæmatoxylin and eosin.

History of Second Case.

S. K., black, about 30 years of age. Complained of spitting blood.

Family History.—Negative.

Personal History.—Denies lues of which he gives no history of secondary lesions. Moderate smoker and drinker but used to drink heavily.

Present Illness.—Few days ago expectorated blood. The patch of leukokeratosis gave him no trouble.

Physical Examination.—Nose, pharynx and larynx normal. Chest, normal. On the roof of the hard palate, extending into the soft palate, is an irregular patch, slightly elevated, in places silvery white, in places deeply pigmented. Feels hard to the touch.

A small piece of this was excised.

History of a Case of Tylosis Palmæ et Plantæ.

The patient, S. W., black, æt. 20, entered Prof. Osler's wards of the Johns Hopkins Hospital October 31, 1898, complaining of pain in the feet.

Family History.—Negative; none of his family had a similar trouble.

Patient's History.—Has had measles and whooping-cough. Denies gonorrhœa and syphilis. Moderate drinker and smoker. He has been healthy except for his present trouble, which, he says, has prevented him from ever doing a whole day's work.

Present Illness.—Ever since the patient can remember he has had callosities on his hands, feet and anus. He says that he has heard people say that they began to appear as soon as he began to walk. He first noticed a row of corns on the palms of each hand and several little white places on his soles. They gradually got worse, assuming the present state in his hands, six to seven years ago. On the soles, the left has remained about the same for the past six to seven years, but during the past three to four months, the right sole has become much worse, having been about the same as the left up to this time. He says he had a similar spot over the left wrist, which he used to pare down continually with his knife, just as he does the other places now. This spot has gradually disappeared. No other growths have disappeared.

There is a constant ache in the horny hard areas. His feet pain him considerably when he walks. There is no itching.

Physical Examination.—The patient is a well-nourished, fairly good-sized, black-skinned negro. There is marked glandular enlargement. Soft systolic murmur heard after the first sound at the apex of heart, faintly heard in the axilla and over the body and base of the heart.

Both knee-jerks are somewhat exaggerated.

The distribution of the lesion of which the patient complains is on the palms of both hands, soles of both feet, over the sacrum, and about the anus. On the palms, extending from the wrist on the ulnar side, to the little- and ring-fingers, is an area about half an inch in width in which the skin is elevated. This patch merges into a similar patch about the metacarpo-phalangeal joints of the fingers, which extend half way down the ring- and middle-fingers. There is also an irregular patch on the thumb and between the thumb and index-finger. The lesions are exactly symmetrical on the palms, as can be seen from the photographs (Fig. 1), which show very well the distribution and character of the lesions. In these areas the skin is somewhat elevated, of a yellowish-white, translucent color and can be readily peeled from the underlying part without causing the patient any pain.

On the soles the distribution is not so symmetrical. On the left sole, the lesions occur in patches; on the inner aspect of the heel is a round patch two inches in diameter, on the middle of the foot is a half-dollar sized patch, over the fifth and second metatarsal bones are two quarter-sized patches. In all these places the skin is raised, hard, greyish-white and somewhat translucent. On the right soles the picture is different. The whole of the heel and outer side of the sole is involved; also the proximal part of the great toe and the distal part of the third and fourth toes. Over the heel is a dollar-sized excavated space, the walls of which are much raised and cornified. There is also a long depression, four by three-quarters inches on the outer side of the sole, the base of which is of a greyish-white color, somewhat sodden, of horny consistence and somewhat tender to the touch. The walls of this depression consist of a wide area of the thickened skin, possessing the characteristics of that before described. At the heel on the right sole and slightly ventral to it the disease is seen and felt to be advancing up the heel for about two inches. Here the skin is harsh, thickened, of a blackish color and hangs down in small folds in places.

There is excessive sweating in the affected areas. In other parts of the body the skin is very dry and cutis anserina is well marked. There is no disturbance of sensation for touch, pain and temperature sense. The affected areas pain him a good deal but do not itch.

Owing to the extent and situation of the lesions in the hand there is marked deformity. The ring- and little-fingers are drawn up as in Dupuytren's contraction and the first phalanx of the thumb is held in an adducted position. The appearance of abduction of the terminal phalanx of the thumb, as seen in the photograph, is not real but is due to the effort to abduct the whole thumb. There is no deformity of the feet.

Besides the lesions on the palms and soles, there are other (similar) lesions on the coccyx and about the anus. Over the coccyx is an irregular, horny projection about the size of a half-dollar, of a yellowish-brown color. Projecting from the right side of the anus is a mass about the size of a hickory-nut, exhaling a peculiar, disagreeable odor. The surface of the mass is, for the most part, of a pinkish-red color. The part nearest the skin is of a yellowish-white color and this blends finally with the normal skin. Just below the the trochanters are two half-dollar sized areas of thickened black skin. The mass about the rectum was excised and the diagnosis of the tissue was epithelial hyperplasia, non-malignant. On the day of admission a small piece of skin was removed from the inner side of the foot, right above the heel. This was fixed in ten per cent formalin and sections were stained with hæmatoxylin and eosin and Van Gieson's stain.

Microscopical Appearances in the Cases of Leukokeratosis Buccalis.

Case I.—The most striking thing about the section, which is extremely well shown by the photomicrograph (Fig. 2), is the extreme thickness of both mucous membrane and submucosa. Secondly, there is present as a new layer, a very thick, horny layer, just as in the skin but much thicker.

The mucous membrane of the patch consists, then, of two distinct layers, an outer horny layer, staining well in eosin, and an inner layer, Malpighian layer, staining well with hæmatoxylin.

On high magnification very indistinct cell-outlines are seen in the outer horny layer but there is no nuclear stain.

The Malpighian layer is much thickened, most of the cells are typical polygonal prickle-cells with well-defined nucleus and nucleolus. Farther out near the horny layer the cell-outline as well as nucleus becomes indistinct. Instead of a well-defined nucleus one sees numerous small, black granules scattered through the cell. An occasional polymorphonuclear leucocyte is seen between the lowest layers of cells. The papillæ have disappeared in great part, but in places very narrow extensions of the submucosa run up into the Malpighian layer. Also in the lower part of this layer are cross-sections of the papillæ. The Malpighian layer is sharply marked off from the submucosa.

The submucosa is very strongly infiltrated with young, round cells which are especially abundant just beneath the Malpighian layer and about the blood-vessels. There is a great deal of proliferation of the connective tissue of the submucosa, shown by the great number of embryonal cells present. There are numerous blood capillaries amongst this tissue which looks as if it is newly formed.

These points are brought out well by Van Gieson's stain, which also accentuates the difference between the inner layer of the Malpighian cells and the outer layer of second rows of cells which are filled with granules.

Case II.—This is practically a reproduction of the changes described in Case I, only all the layers are much thinner. The plaque in this case was not elevated as much above the surface as in Case I. It also differs in that the granular layer, or layer of cells filled with black granules next the horny layer, stands out very distinctly, while it was indistinct in Case I. See Fig. 3.

Microscopical Appearances in the Case of Tylosis Palmæ et Plantæ.

The photomicrograph, Fig. 4, shows very well the great thickness of the epithelium. This section was taken from a part just above the developed spot of the disease. In certain parts, as the heels, slices of horny epithelium one-eighth of an inch thick could be shaved off. The epidermis presents a remarkable appearance, due to the number and arrangement of the layers, which can very well be made out with the low magnification.

Beginning from within, we have the following lesions:

1. Stratum mucosum. Somewhat thickened. Cross-section of papillæ seen in the lower parts of the layer.
2. Stratum granulosum. Three to four layers of cells at outer part of stratum mucosum, showing as a faint blackish line in the photomicrograph. The nucleus is round and distinct, stains intensely with hæmatoxylin, the cells contain blackish granules.
3. A thin area staining a homogeneous pink, and outside of this is a thick band of bladder-like cells. This layer appears as a thick, white band in the photomicrograph.
4. A layer of cells closely packed together with long, thin nuclei staining intensely with hæmatoxylin and cell-bodies staining red with eosin. This shows as a rather thick, black space in the photograph.
5. A thick, reticulated layer staining a faint pink with eosin. The inner two-thirds of this has the appearance of large, long, bladder-like cells, like in layer three; the outer third is composed of homogeneous pink-staining strands.

The papillæ are very numerous and extend rather deep into the mucous layer. Small blood-vessels are rather numerous in the stratum papillare. About some of these are a few young round cells. There is a slight amount of young embryonal tissue in this layer. There is nothing of especial note in the stratum reticulare.

The essential changes in both these diseases are very much alike, namely, first, the process of keratinization resulting in one case in the formation of a new layer, and in the other a great increase in the thickness of the horny layer, and secondly, the infiltration of the corium and submucosa with young round cells. In the cases of leukoplakia this is more marked and the tissue has a more embryonal appearance. The tylosis case was of longer duration and the tissue presented a more organized state of connective tissue.

The difference in the size of the papillæ is perhaps explained partly by the location. Normally the papillæ in the mucous membrane of the buccal cavity are not very well marked, while they are very well marked in the feet.

It is interesting to note that Leloir states that in cases of leukoplakia lingualis complicated by epithelioma, the layer of granular cells stops where the epithelioma begins.

Leukokeratosis buccalis is found on the tongue, inside of cheek opposite where the teeth meet and rub it, rarely on the hard palate, uvula, gums and lips. Schwimmer saw but twenty cases in twenty-thousand cases observed in nine years. Nedopil stated its rarity in the clinic and private practice of Billroth. In the throat department of the Johns Hopkins Hospital Dispensary there have been seen but two cases in the last three years.

The disease occurs between the twentieth and sixtieth years of age, almost always in men. Among twenty-five cases seen by Débove there was not one woman.

The course of the disease is variable. It may remain unchanged for years, the patches merely becoming thicker and thicker. In Hulke's case the patient was in the habit of paring off the superficial layers from time to time. It tends to recur if removed "en masse." The superficial layers may peel off spontaneously, leaving reddened areas. The papillæ on the tongue atrophy, leaving a smooth thickened area. The most serious sequela is the development of carcinoma; this developed in four of Schwimmer's twenty cases. Morris, in a study of the relationship between this disease and carcinoma of the tongue, says that of twenty-five cases of early tongue carcinoma, ten were preceded by icthyosis, usually very diffuse.

Etiology.—It is probable that the mucous membrane of persons developing this disease is peculiarly susceptible, just as the skin of certain individuals is delicate and prone to the development of certain skin diseases. In such people any strong irritation will start the disease. Such an irritation is the use of tobacco, chewed or smoked. Smokers' patches begin usually on the tongue, where the stem of the pipe rests, or where the smoke from the cigar, cigarette or pipe impinges on the mucous membrane, as small reddish spots. In one of our cases the spot developed exactly where the patient was in the habit of holding his quid of tobacco. These patches are covered, after a while, by a yellowish-white or brown material which becomes detached to make place for a fresh covering. The patch tends to spread over the tongue and cheek, and, in time, may turn to a bluish-white or grey-white patch. Alcohol, condiments, very hot and irritating foods and syphilis are potent predisposing causes. The majority of Morris's cases had syphilis and were drinkers and smokers. Schwimmer claims that they can be produced by the action of mercury alone. He says that workers in mercury mines, mirror- and barometer-makers, suffer from inflammation of the mucous membrane of the mouth, with swelling and the formation of ulcers, and also show whitish or bluish-white patches in different parts of the mouth. He has seen luetic cases grow worse under mercurial treatment. Butlin has seen leucomatous areas develop along the line of vulcanite tooth-plates. He also thinks that gout and rheumatism play a part, especially in young people. The French writers lay great stress on these two diseases as etiological factors. Schwimmer found a number of cases coexistent with catarrh of the stomach and intestines, and improvement of the patches occurred with improvement of these diseases.

Symptoms.—Very often, as in our cases, there are no symptoms and the patient only accidentally becomes aware of its presence. There may be a slight dryness and hoarseness, or the sensation of burning in eating, especially highly-spiced food. There is no actual pain. When extensive and thick patches are present, difficulty is experienced in moving the parts. Often the patient complains of great thirst. Taste is unaffected unless the patches are very extensive.

Diagnosis.—In a well-developed case there is no doubt as to the diagnosis. The coloring and extent of the patch, its persistence and hard, elevated surface are enough to establish the diagnosis beyond any doubt. Luetic patches develop quicker and there is enlargement of the neighboring lymph-glands. These patches also tend to disappear, which is rarely the case with leukokeratosis. Spots in the mouth in lichen ruber planus and pemphigus occur with the general skin diseases. Their origin, arrangement and tendency to disappear should differentiate them.

Prognosis.—Recovery is possible when the patches are not so extensive and are soft and pliable. Butlin says, however, that he has never seen a well-developed case recover. The possibility of development of carcinoma in these cases must be thought of and the patient warned of the danger of the malady becoming serious if not attended to.

Treatment.—All sources of irritation should be removed. The use of alcohol and tobacco should be discontinued and the patient avoid very warm and spicy foods and drinks. Rough teeth and badly-fitted plates should be attended to. Constitutional treatment should be carried out in cases of rheumatism, gout, gastric or intestinal disorders. However, in cases of some standing following syphilis, antisyphilitic treatment is of no value, as the use of mercury may aggravate the lesion.

In the milder cases much can be done by the use of alkaline mouth-washes, such as bicarbonate of potash, thirty grains to an ounce of water, chlorate of potash, peroxid of hydrogen. Chromic acid, ten grains to the ounce, is often of use, especially in the cases following syphilis.

When there is quite a thickening of the epithelium, salicylic acid in alcohol (Ac. Salicylic 0.5 to 1, Spts. vini rectificat., aquæ destillat. aa. 10.0), painted on the affected spot every alternate day is of great value. Leloir claims this is good on account of the dekeratinizing action that salicylic acid possesses. A mouth-wash of alum, two grains to the ounce, is of use. If there is an acute inflammation on top of the usual conditions, a mixture of honey and borax may be painted on it.

The use of an ointment on the part as suggested by Butlin is very valuable, especially to be rubbed in at bed-time to keep the part from becoming dry and cracking. Such an ointment may be made of six drachms of lanolin and two drachms of vaselin as a base, with any drug desired, such as boric acid. The use of caustics is to be advised against, as the general consensus of opinion is that they increase the irritation and increase the predisposition to the development of carcinoma.

If the patch is very thick and circumscribed it may be excised. Hulke excised the patch in his case but it had returned on a second observation three years later. Lawrence operated on his case, shaving off the growth with a scalpel. As in Hulke's case, this was followed by profuse hæmorrhage. Lawrence saw his patient seven months after the operation, when the former disease had returned but increased in size. It was again removed.

Ranschoff reports two cases operated on, one well for two years, another for five years after the operation, no scar being left.

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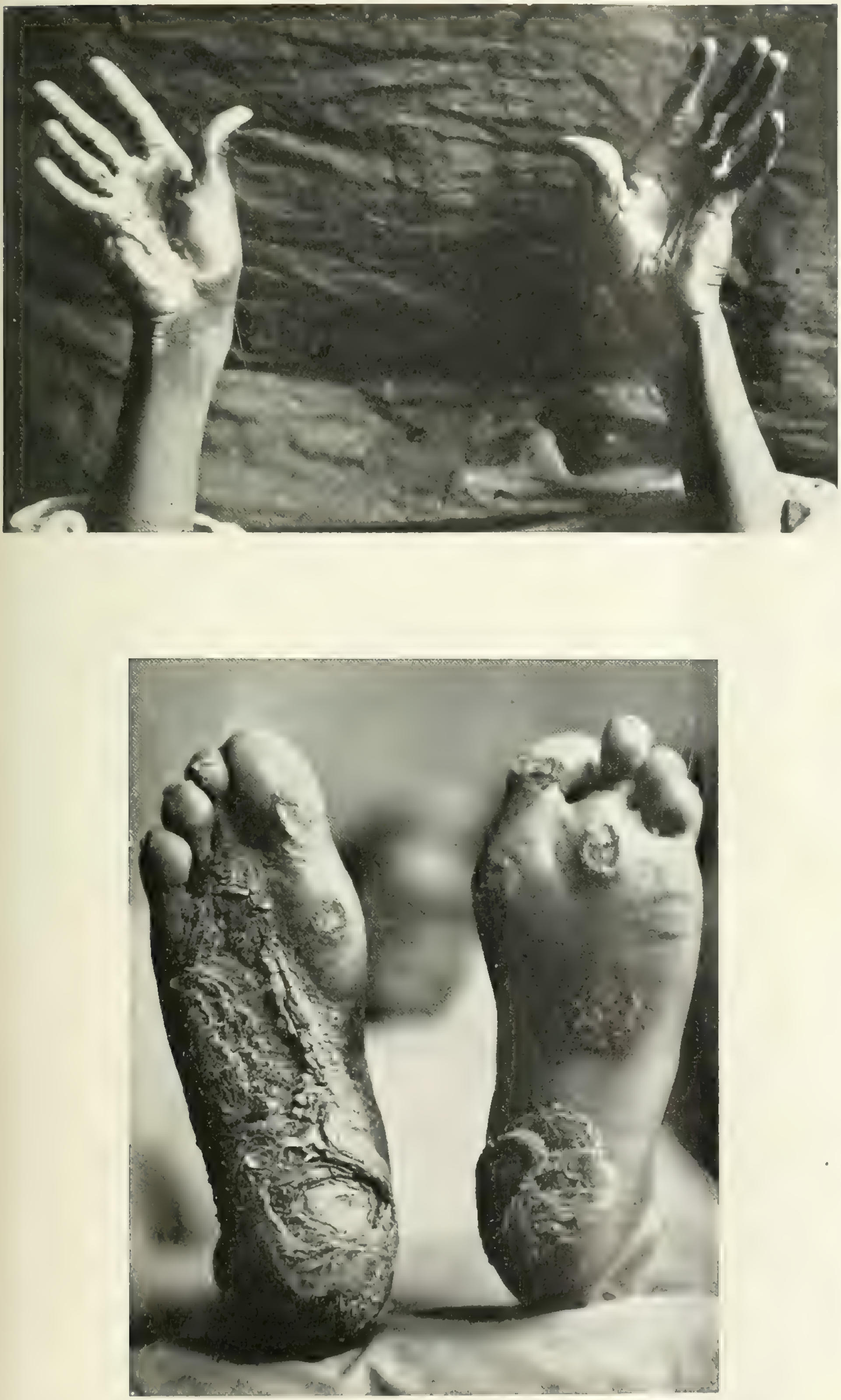

Fig. 1.—Photograph of palms and soles of case of tylosis palmae et plantae.

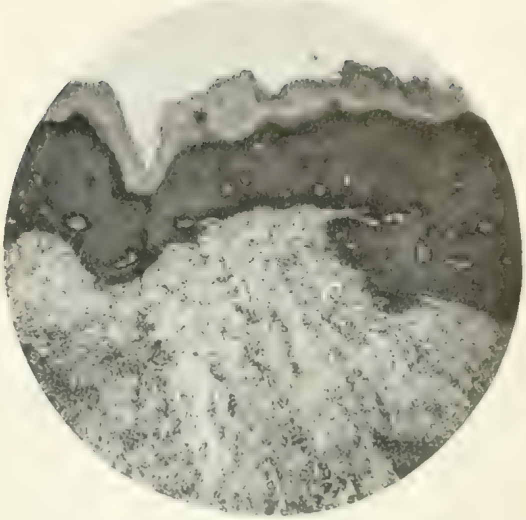

Fig. 2.—Photomicrograph of first case of leukokeratosis buccalis. Dr. Charles H Potter. × 25.

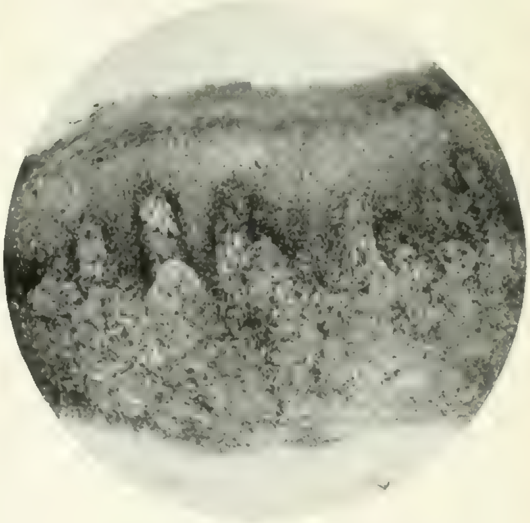

Fig. 3.—Photomicrograph of second case of leukokeratosis buccalis. Dr. Charles H. Potter. × 25.

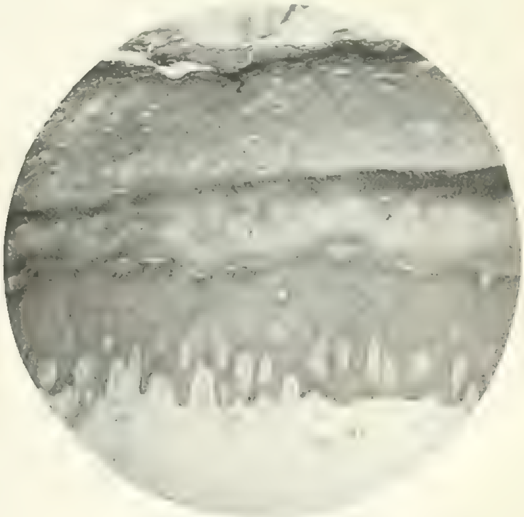

Fig. 4.—Photomicrograph of case of tylosis palmae et plantae. Dr. Charles H. Potter. × 25. Zeiss's planar lenses and Cramer's isochromatic plates.

THE EFFECTS OF X-RAYS UPON LOWER ANIMAL LIFE AND THE TUBE BEST SUITED TO THEIR DESTRUCTION.[1]

By Kennon Dunham, M. D.

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I. The immediate object of this research was to ascertain what effects, if any, X-rays have upon several of the lower forms of animal life; to discover if any of such organisms are destroyed by X-rays and if so, what technique best produces such destruction.

II. The reason for such research is based upon the analogy existing between such lower organisms and the new cells of a malignant growth. What I really wish to establish is a scientific method by which to determine the best form of tube with which to treat such growths; and it seems but fair to allow, upon such analogy, the supposition that the condition of tube that is most destructive to one of these forms will be most destructive to the other.

This does not mean that the most destructive form or arrangement of tubes will be the best for the treatment of epitheliomatous or sarcomatous conditions, for therapeutically you must consider also the effects upon healthy tissue, upon the nerves, the circulation, etc. It simply means that one may have found the first step in considering such treatment, that is, the destruction of the malignant cells. The organisms I chose for my experiments were: *Chilomonas, Paramoecium aurelia, Paramoecium bursaria, Cryptomonas, Rotifera, Arcella.*

III. The only other account of research work along the same line that I have been able to find was that published in Berlin, in 1899, in the Archiv für die gesammte Physiologie des Menschen und der Thiere, by Dr. F. Schaudinn. But Schaudinn's work differs from mine in two important particulars. He is concerned about the number and nature of the lower organisms affected by X-rays and how they were affected; I about the tube and conditions best effecting the destruction of any of them.

Again, his technique, his apparatus and the time given to experiments differed from mine. The modern improvements along these lines permit of my reducing to minutes the fourteen hours he exposed his specimens to the light. The organisms which he found to be destroyed were: *Amoeba princeps* 25 per cent died, *Amoeba lucida,* all died, *Pelomyxa palustris,* all died, *Gromia oviformis,* died, *Actinosphaerium eichhorni,* died, *Chilomonas paramoecium,* died, *Cryptomonas ovata,* died, *Euglena acus,* died, *Oxyrrhis marina,* died, *Spirostomum ambiguum* died. *Cryptomonas* was not destroyed in my experiments. Otherwise these reports mutually prove one another.

IV. I spoke of the difference in technique employed by Schaudinn and myself. It is in regard to the technique that I find the greatest care necessary. Perhaps the points to be most insisted upon are the use of control specimens; the selection of the best rays of the light, as well as the best distance between the tube and the specimen; and the proper method, number and times of exposure. As to control specimens, every possible attention has been paid to them throughout my experiments. Never have I exposed a specimen to the rays, without placing another specimen, as nearly similar to the first as possible, in a lead box safe from the rays. When a specimen has been exposed to the sunlight for microscopical examination, its control has been placed as nearly as possible in the same light even to the condenser where a condenser has been used. In shallow water the specimens are very susceptible to strong sunlight.

There is quite a difference to be noted in the different rays. The strongest are those directed from the centre of the anode plate in a line perpendicular to its face. I also soon discovered that the best results are obtained if a sheet of lead be rolled into a cylinder and the rays directed through this. I considered this focus tube and the proper direction of the rays of great importance. The most destructive rays were produced by a medium low tube excited by a heavy electrical discharge which had been passed across spark-gaps or through other resistance sufficient to produce rays of great penetrative power. Such a tube would give a clear picture of the hip of a man weighing 170 pounds in three and one-half minutes. Very low tubes which show no bones, but only the outline of the hand upon the fluoroscope have shown no effect upon the organisms, nor have the ultra-violet tubes influenced them. Very high tubes which were not heated by the heaviest discharges of my apparatus after ten minutes of exposure, gave very poor results. I used an 18-inch coil.

We have now seen how to get the best rays; I find the distance such rays must travel from the tube to the specimen to be also a matter of great importance. Regarding this, several important conditions must be considered. It is a well-known fact that a high potential current passing through a partial vacuum tube induces a secondary current upon the outside of that tube. This is the principle upon which high-frequency tubes are operated. The high-frequency discharge is in some way very destructive to these organisms if brought into too close relationship with the specimen. The destructive effect may be due to the liberation of ozone, a great deal of which is produced; or it may be due to some form of elective discharge direct. A Crook's tube is a partial vacuum and has passing through it a high potential current, and, therefore, has an induced or high-frequency current upon its outer surface, though this induced current is not nearly so strong as that produced by the high-frequency apparatus. In all experimental work it is necessary to make the tests as simple as possible. I have tried therefore to eliminate the possibility of this induced current affecting my experiments. The high-frequency current which is, as I have said, a much stronger induced current than that from the X-rays, had no effect upon the specimen when removed from it five inches. For this reason the distance of my X-ray tube from the specimen has never been less than five inches. I soon found that the closer the tube the more potent the rays. As five inches was considered the closest I dared to bring the tube in absolute safety, I early adopted five inches as the standard distance.

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[1] Read before the American Roentgen Ray Society, December 10, 1903.

We have spoken of the most destructive rays and the standard distance, let us now consider the exposure of the specimen under these conditions. My method of exposure has been to take a small, thin rectangular frame of brass, such as fits easily upon the ordinary microscopic slide, a counting cell in fact, of the Sedwick-Rafter type as modified by Calkins, Jackson and Whippler. This brass rim is cemented to a glass slide and the cell is 50 mm. long, 20 mm. wide, and 1 mm. deep. The superficial area thus is 1000 sq. mm. and contents 1 cc. This is used for the microscopical quantitative examination of water. As can be seen, this presents to the rays a very broad surface with little depth. It is easily examined under a low-power microscope without a cover-glass. The greatest difficulty is found in keeping sufficient water over the organism. Evaporation is very rapid. This was obviated by having a small cup of water with a piece of absorbent cotton twisted into a wick to extend from the cup to the receptacle on the slide. The slide is placed lower than the surface of the water in the cup and the water is thus gradually drawn to the slide. If the water in the cup is much higher than the slide, the slide will be flooded. The control must be arranged with similar care. The number of exposures varied from three to fifteen. The duration of each exposure was from three to twenty-one minutes. The time allowed between exposures was at first twenty-four hours, later only one hour. When the duration of each exposure was longer than I cared to use my tubes, I allowed an interval of five minutes after each exposure of three minutes. I think that this covers the matter of the technique used throughout the experiments. Perhaps it would be well to take a typical experiment and follow it through, since time will not permit a detailed account of all of those from which my facts have been drawn. I choose one in which any deviation of the technique would give markedly poorer results.

V. Apparatus: Coil 18 inches—mercury turbine interrupted drawing 5½ amperes from a 64-volt storage battery—2 spark-gaps of 3 inches each, 2 vacuum tubes, one high, the other low, in series with a medium low Gundlach tube of 8-inch diameter. The same apparatus worked in a similar manner has taken a good hip picture for me in three and a half minutes. The specimens to be treated were arranged on a slide and controlled as I have previously described. The tube was focused through the lead cylinder, from the center of the anode, with the face of the tube five inches from the slide Upon the slide were:

1—*Chilomonas.*
2—*Paramoecium aurelia.*
3—*Paramoecium bursaria.*
4—*Cryptomonas.*
5—*Rotifera.*
6—*Arcella.*

The extract from my notes reads:

DATE	INTERVAL	EXPOSURE	TIME	SPECIMENS	CONTROL
Nov. 10	....	First	3 min.	No change.	No change.
" "	1 hr. later	Second	" "	" "	" "
" "	2 hrs. later	Third	" "	A little stiff.	" "
" 11	....	Fourth	" "	1 and 2 no mobility; the rest seem sluggish.	" "
" 11	1 hr later	Fifth	" "	1, 2 and 3 no mobility; 4, 5, 6 possibly sluggish.	" "
" 12	.. ..	Sixth	" "	1, 2 and 3 dead; 4, 5 and 6 no change.	" "
" 13	....	Examination		1, 2 and 3, dead; 2 fatty degeneration with high power; 4, 5, 6 no change.	" "
" 15	... .	Examination		1, 2, 3 not seen; 4, 5, 6 no change.	" "

This is an example of research experiments which have been verified by me many times, and I consider that it shows the best method of obtaining the most decided reaction. With higher or lower tubes, with a greater distance between the specimen and the tube, focused differently, or focused without the lead cylinder, the results are less marked, or the necessary time of exposure is longer.

As a general law, living tissue is stimulated when subjected to a properly attenuated destructive force. If this was so with regard to the effect of the X-ray upon the specimens, I failed to note it; but I consider that further work along this line may prove that a tube properly focused, with the current exciting the tube to the proper rays, may produce increased activity among these organisms. But I have failed to note any such result.

Another deduction made from these experiments is that they who claim that the cathode rays and not the X-rays are essential to the destruction of epithelioma are probably wrong. The same tube when excited by a greatly resisted current is much more destructive than when excited by a current of lower potential. The amount of the X-ray in the latter case is practically nothing when compared with the former. In the case of the current of lower potential too, the cathode rays appear to the eye much greater. Therefore, I believe the destruction is due to the X-ray.

VI. Having discussed the technique most effective in these experiments; given an illustration of a typical experiment; and drawn from it such deductions and observations as are best substantiated by all my work, I feel that we are now able to answer the questions asked at the beginning of the research.

First, what effect has the X-ray upon lower organisms? We have seen that some of these organisms are killed by the X-rays, while others are apparently unaffected by it. The *Chilomonas, Paramoecium aurelia* and *Paramoecium bursaria,* all forms of single cell-life belong to the first class, while *Rotifers, Arcella* and *Cryptomonas* were unaffected by the light. *Chilomonas* were the most numerous and showed the first effect of the rays, and after being destroyed, gave decided evidence, under the high power, of fatty degeneration. The Paramoecia were markedly affected but were not nearly so numerous. I noted no fatty degeneration in these specimens, but this was possibly due to lack of sufficient effort. In speaking of the effect of X-rays upon these organisms, we must note again that there was no stimulation prior to death.

The second question asked was: "can any of these lower organisms be destroyed by the X-ray?" This question is almost answered in the first, but it is important to note here that through the use of controls and care in technique we have eliminated as the destructive force any other agency than the X-ray; the most possible of such other agencies being the sunlight, an induced electric current and the cathode rays.

Question three—"what technique best produces such destruction"—has been answered in detail throughout this paper. Should we confine our question to the use of tubes, we can sum up our deductions in three statements. First, the closer the tube to the object treated the more destructive the rays. Second, lower tubes excited by small currents are not so destructive as lower tubes excited by heavier currents, which are resisted. And third, very high tubes have very little effect.

VII. We have now reached our real conclusion. Since we have established what technique best produces destruction of certain lower cells by X-rays and have acknowledged the analogy existing between these lower organisms and new malignant cells we have decided (bearing in mind that the possibility of destroying healthy tissue is to be eliminated) that the best rays to destroy epitheliomatous and sarcomatous cells is the lower tube excited by a heavy current with much resistance.

Thus perhaps our first step towards the cure of these malignant growths has been taken.

AN ANOPHELES MOSQUITO WHICH DOES NOT TRANSMIT MALARIA.

By Leonard K. Hirshberg, A.B., M.D.

(From the Pathological Laboratory of the College of Physicians and Surgeons.)

Anopheles punctipennis abounds in the neighborhood of Roland Park, a suburb of Baltimore, as was demonstrated by us[1] some time ago. Even at that time, in a careful investigation of the health records and specimens sent to Dr. William R. Stokes, City Bacteriologist, I was unable to trace any autochthonous cases of malaria in that neighborhood. After carefully searching through much of the literature[2] on mosquitoes and malaria, and not finding any malaria traceable to *A. punctipennis* as carriers of the parasite, it was determined last summer to put the question to a proof.

The few cases of malaria which occur in Baltimore have their origin as a rule at Sparrow's Point and upon the Eastern Shore of Maryland. At the former place, situated some twelve miles from the city, we found *Anopheles maculipennis* in abundance, but found no other species of Anopheles in numbers. Malaria is constantly endemic there and most of the Baltimore cases are imported from that place. *Anopheles maculipennis* captured there contained malarial parasites in the stomach walls. On the other hand, I have never been able to demonstrate the parasites in the walls of *A. punctipennis* found at Roland Park or elsewhere.

The coincidence of malaria and *Anopheles maculipennis* holds better in Grassi's[8] investigation of the geographical distribution of malaria and mosquitoes than in the case of *Anopheles punctipennis.*

The differences between these two species of Anopheles are now so well known, and can be so easily found in the literature[3] that I shall not stop to consider them. In collecting the larvæ, the method suggested by G. H. F. Nuttall[4] was carried out.

Larvæ of *Anopheles punctipennis* were collected from streams in the grounds of the Baltimore Country Club at Roland Park and measured from 2.4 mm. to 8.1 mm. in length. About the same time, in order to have controls, larvæ of *Anopheles maculipennis* were obtained from the inlets about Sparrow's Point. Most of these larvæ, owing to the cool weather, did not metamorphose into pupæ until from fourteen to eighteen days. They were fed upon spirogyra and algæ of various kinds.

The imagoes developed from the pupæ in from two to five days. The imagoes were fed upon fresh fruits, juices, preserves and sugar water, kept constantly in the mosquito cages.

When an available case of malarial infection presented itself, the following method[5] was carefully explained to the patient and his consent and co-operation obtained. The lobe of the ear or the extensor surface of the hand was carefully cleaned some time before the mosquitoes were brought in contact with the patient. This was done because the female mosquitoes would not bite the skin which had been freshly cleaned with various solutions such as soap, ether, alcohol and bichloride.

An adult female *A. punctipennis* and an *A. maculipennis* were then placed in separate test-tubes plugged with cotton and covered with black paper. It was found that the mosquitoes would bite more quickly in this way, than if the tubes were held under the cover-slips. The act of biting could also be better observed through the small part of the tube near its mouth, which was not covered.

Patients suffering with estivo-autumnal malaria showing crescents in the peripheral circulation were the only ones considered available.

After one female adult of each species had bitten the patient and become quite swollen with the blood they were each taken away and incubated at a temperature of 30° C., as described by Bignami and Ross.[7] The mosquito was then anæsthetized by ether and fixed upon a piece of colored glass by a needle passed through the thorax. If a needle is lightly pressed at the third abdominal segment and drawn apart from the other one by gentle traction, the entire intestine is withdrawn. This is best done in a normal saline solution. The salivary glands are obtained for examination by fixing the thorax and detaching the head lightly with a needle, when, as a rule, the tubes and ducts become visible. At times it becomes necessary to take away a segment of the thorax. Marchiafava and Bignami[8] have described this procedure in detail.

After the infected mosquitoes have been incubated at 30° C. for periods varying from forty-eight hours to seven days, the intestinal wall in the successfully inoculated Anopheles showed in the early stages the zygotes with the peripherally arranged pigment. The mosquitoes dissected after the third day showed little pigment in the parasites, but indicated a well-determined capsule. Later stages again demonstrated the nucleated hyaline cystic bodies and the filamented sporozoites. The salivary glands contained parasites (sporozoites) only after the eighth day.

In forty-eight attempts to inoculate the *Anopheles punctipennis* from five cases of estivo-autumnal malaria in which crescents were easily and constantly demonstrated in the blood, there was absolutely no evidence of the parasites in the stomach walls, intestines, body cavity or salivary glands after the most minute search. At the same time in the controls with the *Anopheles maculipennis,* the parasites were demonstrated successfully eight times.

In the summer of 1900, ten attempts to successfully inoculate females of *A. punctipennis* were also made by me.* The patients all showed numbers of crescents in the circulating blood, as was verified by two other competent observers. At this time, although I carefully followed the directions of Marchiafava, Grassi, Ross and Thayer,[9] my failure was attributed to faulty technique. There was perhaps some reason for this, because experiments with *A. maculipennis,* carried out at that time, were also unsuccessful in six attempts at inoculation, although a seventh one showed some few doubtful-looking sporozoites. The experiments at that time were never persistently carried out and only a note[1] made of them incidentally.

Including these attempts, it would seem to be at least suggestive that in the fifty-eight exposures of female *A. punctipennis* to infection with estivo-autumnal malaria having crescents in the peripheral circulation, no parasites were ever demonstrable in the intestinal wall, body cavity or salivary tubules. In order to present the results graphically the following rough diagrams have been arranged. The incubation time after the mosquito had satiated itself with the patient's blood, the presence or absence of parasites in the dissected mosquitoes, their anatomical position *in situ,* and the stage of development are given.

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* At the Johns Hopkins Hospital.

CASE A. ÆT. 34. M. CRESCENTS IN GREAT NUMBERS.

	Parts Bitten.	Incubated 30° C.	Parasites.	Where Found.	Stage of Development.
1. *A. Punctipennis*	Thumb	48 hrs.	O	O	O
1. *A. Maculipennis*	Thumb	48 hrs.	O	O	O
2. *A. Punctipennis*	Ear lobe	3 days	O	O	O
2. *A. Maculipennis*	Ear lobe	3 days	O	O	O
3. *A. Punctipennis*	Ear lobe	4 days	O	O	O
3. *A. Maculipennis*	Ear lobe	4 days	+	Muscular wall of intestine	Well defined capsulated parasite
4. *A. Punctipennis*	Ear lobe	4 days	O	O	O
4. *A. Maculipennis*	Ear lobe	4 days	O	O	O
5. *A. Punctipennis*	Ear lobe	3 days	O	O	O
5. *A. Maculipennis*	Ear lobe	3 days	O	O	O
6. *A. Punctipennis*	Thumb	3 days	O	O	O
6. *A. Maculipennis*	Thumb	3 days	O	O	O
7. *A. Punctipennis*	Back of wrist	4 days	O	O	O
7. *A. Maculipennis*	Back of wrist	4 days	O	O	O
8. *A. Punctipennis*	Back of hand	5 days	O	O	O
8. *A. Maculipennis*	Back of hand	5 days	O	O	O
9. *A. Punctipennis*	Back of hand	5 days	O	O	
9. *A. Maculipennis*	Back of hand	5 days	+	Buds from intest. wall	Reticulated capsulated parasite
10. *A. Punctipennis*	Back of hand	5 days	O	O	
10. *A. Maculipennis*	Back of hand	5 days	+	Buds in intest. walls	Capsular nucleated masses
11. *A. Punctipennis*	Back of hand	7 days	O	O	O
11. *A. Maculipennis*	Back of hand	7 days	O	O	O
12. *A. Punctipennis*	Back of hand	7 days	O	O	
12. *A. Maculipennis*	Back of hand	7 days	O	O	
13. *A. Punctipennis*	Back of hand	7 days	O	O	
13. *A. Maculipennis*	Back of hand	7 days	O	O	

Thirteen tests with each
A. punctipennis
A. maculipennis

Three successful inoculations of
A. maculipennis

CASE B. M. ÆT. 29. W. CRESCENTS IN BLOOD.

	Parts Bitten.	Incubated 30° C.	Parasites.	Where Found.	Stage of Development.	
1. *A. Punctipennis*	Back of hand	5 days	O	O	O	
1. *A. Maculipennis*	Back of hand	5 days	O	O	O	
2. *A. Punctipennis*	Back of hand	5 days	O	O	O	
2. *A. Maculipennis*	Back of hand	5 days	O	O	O	
3. *A. Punctipennis*	Back of hand	5 days	O	O	O	
3. *A. Maculipennis*	Back of hand	5 days	O	O	O	
4. *A. Punctipennis*	Lobe of ear	5 days	O	O	O	
4. *A. Maculipennis*	Lobe of ear	5 days	O	O	O	
5. *A. Punctipennis*	Lobe of ear	7 days	O	O	O	
5. *A. Maculipennis*	Lobe of ear	7 days	O	O	O	
6. *A. Punctipennis*	Lobe of ear	9 days	O	O	O	9 experiments with *A. punctipennis*
6. *A. Maculipennis*	Lobe of ear	9 days	O	O	O	
7. *A. Punctipennis*	Lobe of ear	3 days	O	O	O	
7. *A. Maculipennis*	Lobe of ear	3 days	O	O	O	
8. *A. Punctipennis*	Thumb	4 days	O	O	O	9 experiments with *A. maculipennis*
8. *A. Maculipennis*	Thumb	4 days	O	O	O	
9. *A. Punctipennis*	Back of hand	3 days	O	O	O	
9. *A. Punctipennis*	Back of hand	3 days	O	O	O	

CASE C. F. COL. ÆT. 24. CRESCENTS PRESENT.

	Parts Bitten.	Incubated 30° C.	Parasites.	Where Found.	Stage of Development.	
1. *A. Punctipennis*	Lobe of ear	3 days	O	O	O	
1. *A. Maculipennis*	Lobe of ear	3 days	O	O	O	
2. *A. Punctipennis*	Back of hand	3 days	O	O	O	
2. *A. Maculipennis*	Back of hand	3 days	O	O	O	
3. *A. Punctipennis*	Back of hand	4 days	O	O	O	
3. *A. Maculipennis*	Back of hand	4 days	O	O	O	
4. *A. Punctipennis*	Lobe of ear	4 days	O	O	O	
4. *A. Maculipennis*	Lobe of ear	4 days	O	O	O	
5. *A. Punctipennis*	Back of hand	5 days	O	O	O	Twelve attempts with each *A. punctipennis* *A. maculipennis*
5. *A. Maculipennis*	Back of hand	5 days	O	O	O	
6. *A. Punctipennis*	Back of hand	5 days	O	O	O	
6. *A. Maculipennis*	Back of hand	5 days	+	Beeds from intestine	Capsular, nucleated parasites	Two successful infections of *A. maculipennis*
7. *A. Punctipennis*	Back of hand	6 days	O	O	O	
7. *A. Maculipennis*	Back of hand	6 days	O	O	O	
8. *A. Punctipennis*	Back of hand	5 days	O	O	O	
8. *A. Maculipennis*	Back of hand	5 days	O	O	O	
9. *A. Punctipennis*	Back of hand	7 days	O	O	O	
9. *A. Maculipennis*	Back of hand	7 days	O	O	O	
10. *A. Punctipennis*	Back of hand	7 days	O	O	O	
10. *A. Maculipennis*	Back of hand	7 days	O	O	O	
11. *A. Punctipennis*	Back of hand	7 days	O	O	O	
11. *A. Maculipennis*	Back of hand	7 days	+	Intestinal wall	Capsulated parasite with sporozoites	
12. *A. Punctipennis*	Ankle	7 days	O	O	O	
12. *A. Maculipennis*	Ankle	7 days	O	O	O	

CASE D. M. W. ÆT. 60. CRESCENTS IN GREAT NUMBERS.

	Parts Bitten.	Incubated 30° C.	Parasites.	Where Found.	Stage of Development.	
1. *A. Punctipennis*	Palm of hand	4 days	O	O	O	
1. *A. Maculipennis*	Palm of hand	4 days	+	Intestine	Capsulated parasites	
2. *A. Punctipennis*	Back of hand	4 days	O	O	O	
2. *A. Maculipennis*	Back of hand	4 days	O	O	O	
3. *A. Punctipennis*	Lobe of ear	4 days	O	O	O	
3. *A. Maculipennis*	Lobe of ear	4 days	O	O	O	
4. *A. Punctipennis*	Back of hand	4 days	O	O	O	Twelve exposures of *A. punctipennis* *A. maculipennis*
4. *A. Maculipennis*	Back of hand	4 days	O	O	O	
5. *A. Punctipennis*	Back of hand	4 days	O	O	O	
5. *A. Maculipennis*	Back of hand	4 days	O	O	O	
6. *A. Punctipennis*	Back of hand	7 days	O	O	O	Three successful infections in *A. maculipennis*
6. *A. Maculipennis*	Back of hand	7 days	O	O	O	
7. *A. Punctipennis*	Back of hand	7 days	O	O	O	
7. *A. Maculipennis*	Back of hand	7 days	O	O	O	
8. *A. Punctipennis*	Back of hand	8 days	O	O	O	
8. *A. Maculipennis*	Back of hand	8 days	+	Intestine and body cavity	Liberated sporozoites	
9. *A. Punctipennis*	Back of hand	8 days	O	O	O	
9. *A. Maculipennis*	Back of hand	8 days	O	O	O	
10. *A. Punctipennis*	Back of hand	9 days	O	O	O	
10. *A. Maculipennis*	Back of hand	9 days	O	O	O	
11. *A. Punctipennis*	Back of hand	10 days	O	O	O	
11. *A. Maculipennis*	Back of hand	10 days	+	Salivary tubules Body cavity	Numbers of free sporozoites	
12. *A. Punctipennis*	B'k of fo'arm	10 days	O	O	O	
12. *A. Maculipennis*	B'k of fo'arm	10 days	O	O	O	

CASE E. M. W. ÆT. 21. CRESCENTS FOUND ONCE.

	Parts Bitten.	Incubated 30° C.	Parasites.	Where Found.	Stage of Development.
1. *A. Punctipennis*	Back of hand	48 hrs.			
A. Maculipennis	Back of hand	48 hrs.			
A. Punctipennis	Lobe of ear	48 hrs.			
A. Maculipennis	Lobe of ear	48 hrs.			

The patient did not return to the dispensary

The last patient entered very enthusiastically into the plan, but did not return to the dispensary for many weeks subsequent to his first appearance. The parasites had then disappeared from his blood.

It was found that the bites on the dorsal surface of the hands annoyed the patients least. These itched less, the swelling disappeared more quickly and the bites were more amenable to treatment in this position. It was sometimes found necessary to produce four or five bites at one time. The part was then wrapped in sterile gauze moistened in ammonia or bicarbonate of sodium with glycerine. The itching and œdema usually disappeared very quickly.

The evident difficulty experienced in obtaining successful inoculations of *A. maculipennis* militates somewhat against the conclusion that *A. punctipennis* does not transmit or propagate the plasmodia of estivo-autumnal malaria. Taken, however, with the geographical distribution of malaria and *Anopheles punctipennis,* and the absence of any reference whatever in the literature of this species as having been found with parasites, it would seem to be at least strongly corroborative. Farther than this I do not claim to go.

In concluding I desire to express my appreciation to Dr. William F. Lockwood, Professor of Clinical Medicine of the College of Physicians and Surgeons, and to Dr. Samuel T. Darling, Resident Pathologist of the Baltimore City Hospital, for their kind assistance in this study.

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PROCEEDINGS OF SOCIETIES.

THE JOHNS HOPKINS HOSPITAL MEDICAL SOCIETY.

October 12, 1903.

The following officers were elected for the ensuing year: President, Dr. Thomas B. Futcher; Secretary, Dr. Charles P. Emerson.

Demonstration of Medical Cases. Dr. McCrae.

Twice within the past two years I have exhibited before this Society a man suffering with aneurism of the thoracic aorta, who presented very unusual features. We presented the case as one of "wandering aneurism," for want of a better name.

The patient was a colored man, 49 years of age when admitted the first time in December, 1901. His previous history was negative. Three months before admission he had caught cold, there had been a cough and a great deal of pain in the chest. Examination showed nothing unusual except slight dulness on percussion to the left of the manubrium. He returned to his work, but was readmitted in October, 1902. He then had a pulsating swelling to the right side of the thorax extending from the outer border of the sternum to the nipple line. The pulsation could be seen from the foot of the bed. There was a diastolic shock and a systolic impulse over the tumor. There was no definite pulsation to the left of the sternum. On October 17 we noted that the swelling was rather less, but it was present until the 19th, on which day it was observed at ten o'clock, but had completely disappeared at noon, and there was then a swelling to the left of the sternum; that is, the prominence had moved from one side of the thorax to the other. The blood pressure then became markedly less in the left radial artery. On October 30 the visible tumor again moved from the left to the right side and this condition persisted until his discharge on the 31st of December. At that time the patient was shown here, and there was some discussion regarding it, but no one had any satisfactory explanation to offer.

His third admission was in March, 1903, when there was a marked precordial bulging, systolic retraction and other signs of adherent pericardium. The swelling was now on the left side again, but within a month it moved to the right once more and remained that way until death. For some months the dulness over the left side increased very markedly.

We always hope that the autopsy will clear up anomalous symptoms of this kind, but that we were able to do so in this case is very doubtful. I have the specimen of the aneurism, but cannot tell why it moved about from side to side. The heart, aorta and lungs were removed *en masse* and you can see the relation of all these. The aneurism is directly above the heart and the lungs are pushed aside. It arose from the arch above the aortic valves. The portion to the right, which came well over to the right margin of the sternum, and which corresponded to the area where the pulsating tumor appeared, is very thin. Below and to the right it is filled with clot. There is adherent pericardium and the lungs showed marked adhesions as well.

The only explanation I can offer for the sudden appearance of the tumor to the right is that there had been probably a sudden extension in size of the aneurism, represented by this thin-walled portion, but, of course, this is only conjecture. As to why it should disappear on the right and move to the left side, I cannot say. The apex of the heart moved definitely across when the aneurism shifted to the right, and possibly it was only the varying relationship between the heart and lungs, from the pressure, that gave the impression of moving. One interesting point was the fact that death seemed directly due to rupture into the pericardium behind, where it was not adherent. The trachea shows some signs of erosion, and the probability is that before long there would have been a perforation. The left lung is very much contracted, practically imbedded in adhesions, and the bronchi were filled with purulent material, but there was no cough and no gangrene. There was a second aneurism of the descending portion of the arch. Sections of the lung show extreme collapse and resemble connective tissue instead of cells.

Discussion.

Dr. Futcher.—One feature of interest in the case was brought out by the X-ray photographs. Two or three different photographs were made and with the shifting in the position of the pulsation there always seemed to be a corresponding change in the position of the shadows as seen on the plates.

The patient had pretty definite symptoms and signs of adherent pericardium and, as you will see from the specimen, the parietal pericardium was almost completely adherent to the visceral.

Demonstration of Surgical Cases. Dr. Follis.

The first patient was a woman, aged forty-five, who was brought to the Hospital with a wound in the right lumbar region caused by a 38-caliber revolver. Her last meal had been taken four hours before admission, and she was seen two hours after the accident. Examination showed abdominal rigidity, normal temperature, and leucocytosis of 30,000. The abdomen was opened through the right rectus, and the cavity found full of bloody fluid and bowel contents. Eleven intestinal and six mesenteric perforations were found. Two in the cecum and two in the ileum were closed. The portion of gut containing the seven remaining perforations was excised, and the two bowel ends left in the abdominal wall. The patient reacted well, and her condition was good for two weeks, but on account of her failing nutrition (due to the loss of fluid matter through the high fecal fistula), an extra peritoneal lateral anastomosis was done by the elastic-ligature method. The patient did well, and after six weeks the bowel ends were excised and turned in under cocaine.

The second case was a colored boy, aged ten years, who was admitted with typical signs of peritonitis and of typhoid fever, including a positive Widal. He was immediately explored, and an intestinal perforation found about 25 cm. above the ileo-cecal valve. The ends of the bowel were brought to the abdominal wall and left there. The patient had a post-operative pneumonia of the right side, developed a large abscess of the right thigh, subsequently suffered acute intestinal obstruction due to the omentum, and was sick with the measles for one month. The enterostomy wound was fully closed under cocaine, and the patient recovered completely. Enterostomy in general peritonitis, with distention, is not a new procedure, having been done by Doyen of Paris, and from one of the Vienna clinics we are told that a typhoid perforation should never be closed, but should be left as a natural avenue for drainage.

DISCUSSION.

DR. MCCRAE.—Dr. Follis is to be congratulated on his good result, and there is one lesson to be learned from this boy—that the typhoid patient with perforation should be given the chance of benefit by operation even when general peritonitis is well advanced. We had thought there was almost no chance of saving this boy. During the last year we have had three cases admitted with general peritonitis and all were operated upon, with the result of saving one out of the three. Curiously enough, our surgical record on all cases of typhoid perforation is a saving of just that proportion—33⅓ per cent.

October 26, 1903.

The meeting was called to order by the President, Dr. T. B. Futcher.

Some Recent Cases of Extra-uterine Pregnancy. DR. CULLEN.

I shall mention only the salient details in each case.

Case I.—Mrs. H., about 30 years of age, admitted to the Johns Hopkins Hospital July 18, 1903. This patient had been nursing a young child and has not been menstruating. For several weeks there has been very severe pain in the left iliac region. On making a vaginal examination under ether the pelvis was found to be partly filled with an irregular mass which broke up readily under the finger, strongly suggesting pelvic clots occurring where rupture of a tubal pregnancy had taken place.

July 20.—On opening the abdomen I found a ruptured extra-uterine pregnancy on the right side. The tube near its outer end was fully 2.5 cm. in diameter. The pelvis was filled with tarry-looking clots and there was also some free blood in the abdomen. The tube was removed, the clots washed out with salt solution and considerable solution was left in the abdominal cavity. Recovery normal.

In this case, as the patient was nursing her child and not menstruating, we had not this sign to determine whether pregnancy existed. The rupture had evidently been a small one and the loss of blood gradual, as the patient gave no distinct signs of internal hæmorrhage.

Case II.—Mrs. H., aged 35, seen in consultation with Dr. Robert Hoffman July 20, 1903. There was a cessation of the flow for at least two and a half months and then a bloody discharge for a few days. While standing at a table she had a sudden and severe pain, especially in the left lower abdomen, and was compelled to drop to the floor. She was exceedingly pale and the abdomen swelled up " like a barrel." The abdominal distention gradually subsided, the pallor lessened and she was able to move around. The uterus was slightly enlarged and to the left was a definite mass fully as large as a baseball. I advised immediate operation. On opening the abdomen the left tube was found above the pelvic brim and adherent to the mesentery of the small intestine. In the abdomen there was considerable blood fluid. The left tube near its proximal end was normal in caliber, but in the vicinity of the fimbriated extremity 2.5 cm. in diameter and ruptured over an area 3 cm. Here the placental tissue was projecting through and the fœtus had escaped. The pelvis was filled with clots. The tube was removed and the pelvis irrigated with salt solution. On the left side of the bladder was a roughened area 4 x 5 cm. where the blood clot had partially organized. It was impossible to peel this off without leaving a bleeding surface. It was therefore not disturbed. The abdomen was closed without drainage. Recovery normal.

This case demonstrates what large hæmorrhages may occur and yet the patient finally recover. I have noticed that where the patient is a nullipara and has firm abdominal walls that the hæmorrhage is not as a rule very severe, as in a short time the abdominal cavity is full and no more bleeding can take place. In those women where the abdominal walls are very lax the abdomen can accommodate a great quantity of fluid and fatal hæmorrhages are more prone to occur.

Case III.—Mrs. S., aged 30, seen July 29, 1903, with Dr. James Linthicum. The patient was perfectly well until three weeks ago, when, while running a sewing machine, she suddenly experienced severe pain in the right iliac fossa. She soon became blanched and was forced to go to bed. Once or twice since then there have been paroxysms of pain accompanied by weakness. Since the first appearance of pain there has been a bloody vaginal discharge and a great deal of discomfort in the right iliac region. The cervix is rather soft, the uterus slightly enlarged. To its right is an irregular mass the size of a small cocoanut. Extra-uterine pregnancy was diagnosed and operation advised.

We found some free blood in the abdomen and on drawing the omentum back discovered a pregnancy in the right tube. At the uterus the tube was normal in size but rapidly dilated, forming a mass 5 cm. in diameter. Anteriorly this was intact, posteriorly blended with the omentum, small intestine and large blood clot. The right tube and a portion of the ovary were removed. Recovery normal.

In this case there was not the slightest suspicion of pregnancy until rupture of the tube occurred.

Case IV.—Mrs. S., aged 28; admitted to the hospital August 3, 1903. Since her last period, one month ago, there has been a continual hæmorrhagic vaginal discharge. For three weeks she has complained of constant pain in the left ovarian region and since the flow came on this pain has become excessive. She came saying that for the last 24 hours the pains had been "labor-like" in character and she felt that "something must come away." On examination I found the uterus very little enlarged, but on the left side an indefinite thickening could be detected. More accurate details could not be obtained on account of the thick abdominal walls.

Three hours later on opening the abdomen I found the left tube much altered. Near the uterus it was 5 mm. in diameter but rapidly increased in size and at its fimbriated extremity it was adherent and reached 2.5 cm. in diameter. It was dark blue in color and filled with blood. It was a very early tubal pregnancy. Both tubes were removed, as the right was occluded, due to an old inflammatory process.

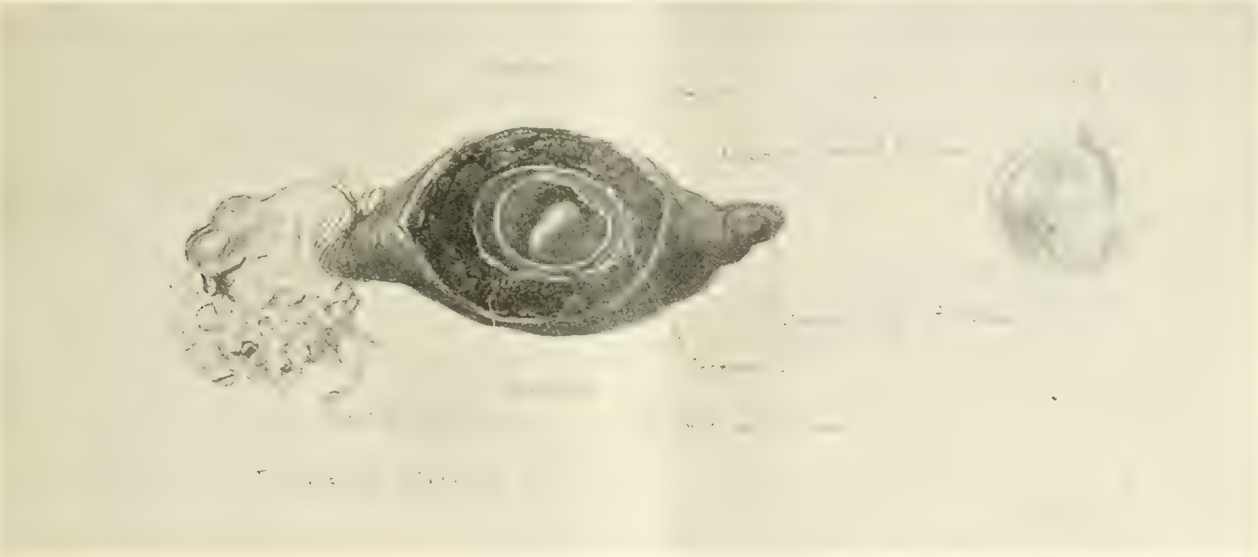

FIG. 1.—Tubal pregnancy with placenta, membranes and foetus intact (natural size). The uterine and fimbriated ends of the tube are normal. Occupying the centre of the tube is an early pregnancy. The placenta and membranes are clearly outlined. The foetus is nearly 1 cm. in length.

The recovery was a normal one. In this case the history was so characteristic that a fairly accurate diagnosis was possible before rupture.

Case V.—Mrs. W., about 35 years of age, seen with Dr. Thomas Talbott, August 16, 1903. For the last month this patient has had a faint hæmorrhagic discharge. Less than 48 hours ago she was seized with pain in the right ovarian region. The pain was paroxysmal in character and so severe that morphia did not control it. She herself said that the pains were "labor-like" in character. There was no elevation of temperature. At 10 P. M. her pulse was 80. When I saw her two hours later the pulse was 100 and some pallor was evident. On vaginal examination there was a faint evidence of thickening on the right side and I confirmed the diagnosis which Dr. Talbott had already given. We were also of the opinion that rupture had taken place after 10 P. M. on account of the quickened pulse, the pallor and the coincident cessation of pain. She was immediately removed to the hospital, and as the pulse was of good volume and did not become more rapid, operation was deferred until morning. On opening the abdomen the tell-tale dark bloody appearance was evident. The right tube at its uterine end was normal about 1.5 cm. distal to the cornu, became fully 2 cm. in thickness and had a markedly bluish appearance. At one point on the posterior surface was a small rupture; the fimbriated end of the tube was normal. The tube contained an intact placenta and a very small fœtus (Fig. 1). The abdominal cavity contained fully 500 cc. of clots and in the region of the liver and also on the left side was considerable blood. The abdominal cavity was irrigated and closure was followed by normal recovery.

This is also another example of an extra-uterine pregnancy presenting a typical history, and Dr. Talbott deserves much credit for having made the diagnosis prior to rupture. It is exceptional to find such a perfect fœtus in a tubal pregnancy.

Case VI.—Mrs. H., aged 34, seen with Dr. Ernest Johnston, of Berkeley Springs, W. Va., September 30, 1903. The patient has had six children; the youngest is 11 months old. She has had no periods since the birth of the last child. Four weeks ago she was seized with severe cramp-like pains coming on suddenly while standing in a store. Ever since then there has been a bloody vaginal discharge. When the cramps first came on she became very pale. On examination under ether I found the cervix hard, the uterus slightly enlarged and a nodule above and to the right of the right cornu; it felt very much like a myoma. Douglas' pouch was filled with an ill-defined mass. I could not tell whether we were dealing with a myomatous uterus associated with pelvic peritonitis or with an extra-uterine pregnancy. Dr. Johnston, however, felt sure that it was a tubal pregnancy. On opening the abdomen we immediately encountered dark blood. What was supposed to be a myomatous nodule was an enlarged right tube, which was fully 5 cm. in diameter and somewhat kinked. The pelvis was filled with tarry blood. The tube was removed. Recovery normal.

This case is also interesting on account of the fact that the patient was still nursing her babe and was not menstruating, and consequently there was no menstrual clue.

While it is exceptional to see so many cases of tubal pregnancy in so short a period, yet I think we must admit that this disease is a common one and that in all probability many cases have been overlooked. Undoubtedly there are cases where no symptoms are manifest until rupture of the tube has occurred, yet in the majority of cases the clinical picture is characteristic, and I feel sure that in the near future many more cases will be recognized before rupture has occurred. Even in this small group of cases, two out of six were detected before hæmorrhage developed.

In all of our cases placental tissue was detected either macroscopically or on histological examination.

Discussion.

Dr. Osler.—I do not think that these cases were overlooked previously; I used to see them—post mortem—that was a very common experience.

Dr. Cullen.—But post mortems were not very frequently made until recently.

Dr. Osler.—Yes, but even among those that were made they were common, and those of you who can go back, say 25 years, will remember that ante-mortem diagnosis was very rare. At the Day of Judgment, when gynæcologists have to confess their sins of omission and of commission, we shall see the figure of Lawson Tait rise up in vindication, and their sins will be blotted out for the sakes of the lives of women they have saved in the class of cases described by Dr. Cullen this evening.

Dr. Cullen.—Dr. Osler having alluded to Lawson Tait in this connection, I want to add that we owe more to him than to any one else for the development of knowledge on this subject.

A Case of Typhoid Arteritis. Dr. Walter R. Steiner.

The patient was a boy, aged nine years, who had a very severe infection of typhoid fever, followed by two relapses. In the interval between the two relapses, on the forty-first day of the disease, an arteritis of the right axillary, brachial and radial arteries was noted. The pulse was wanting in the axillary vessel for three days, but in the brachial and axillary arteries thirty-five days had elapsed before it was again felt. [illegible] return of pulsation was complete in all of these arteries.

Discussion.

Dr. Thayer.—In connection with this remarkable case it will be remembered that we have had several similar instances in the hospital—cases which I brought together last year.

In considering the question of the vascular complications of typhoid fever within the last year I have been impressed with their frequency and importance. Typhoid fever not only plays an important part in the production of phlebitis and arteritis in smaller vessels, but it is not improbable that it sometimes gives rise to more extensive and widespread changes in the arterial system. Some clinical studies upon our old typhoid fever patients which I have recently been making, and which I hope soon to report, indicate that typhoid fever plays a definite rôle in the etiology of arteriosclerosis.

Potain has described acute aortitis occurring in the course of typhoid fever which he believes is susceptible to recognition during life. I have never seen such a case.

Dr. Osler.—How did you account for the favorable change? Was it by anastomosis?

Dr. Steiner.—I thought it was simply that the inflammation subsided in the arteries.

Dr. Osler.—That is probably the best explanation; that the occlusion was simply due to swelling of the walls—without thrombosis. It is difficult to suppose that it was by anastomosis, and I do not think that canalization ever takes place to the extent of restoration of a full pulse.

Some observations have been made lately as to the action of lime salts in adding to the coagulability of the blood and assisting thrombosis and suggesting that materials containing an excess of lime should be removed from the diet of these patients.

Dr. Futcher.—Thrombosis of the arteries in typhoid cannot be of such great infrequency as we might at first suppose. Dr. Keen a few years ago collected 115 cases from the literature. In 46 of these the arteries of the lower extremities were involved. In 8 the thrombosis was bilateral; in 19 right-sided and in 19 left-sided. This is in contrast to what one finds in venous thrombosis of the lower extremities, where the left side is much more frequently affected than the right.

Dr. Thayer.—How great the real and apparent occlusion of an artery may be from simple swelling of the walls is shown by an observation of Tuthill (Trans. Med. Soc. N. Y., Syracuse, 1885, 222), who states that in a leg amputated for gangrene the only artery found pervious was the posterior tibial, from which the blood escaped in "fine needle-like jets." In such an artery it is highly probable that the pulsation would be entirely impalpable.

In connection with this it may be of interest to mention a very remarkable case, the report of which was given to me recently by Dr. Royster, of Norfolk. The case was that of a little girl of eight, who, two years ago, toward the end of a rather severe typhoid fever, became suddenly unconscious and presented rigidity of the neck, paralysis of the left side, the face, arm and leg, together with paralysis of the third nerve on the right side. After several days, the paralysis cleared up, but since then, at various intervals, there have been typical attacks of Jacksonian epilepsy with spasm of the left side of the body and of the right lid and pupil.

DR. PLEASANTS.—I would like to ask Dr. Steiner if it is not possible that he had to deal here with thrombosis of the vein, which by pressure on the artery would have produced this condition?

DR. STEINER.—I do not think that thrombosis of the adjacent vein would have obliterated the pulse entirely. Dr. Janeway thought there was no doubt about the presence of arteritis, and while the pulse recurred in the axillary artery in three days it did not return in the radial and brachial until the lapse of 35 days.

The Treatment of General Infections, with Especial Reference to the Use of Silver Nitrate in Such Cases. DR. JOSEPH HUME.

DISCUSSION.

The surgical treatment of general infection aims at free drainage, stimulation and increased elimination. The injection of salt solution, the administration of antitoxines, and the introduction of antiseptics into the blood illustrate these fundamental principles. It has often been observed that infection causes a rise in the leucocyte count. It therefore seemed that possibly an effort artificially to increase the white blood count was indicated. Silver nitrate has this effect, and hence it has been used in the treatment of infections. Possibly it does good by destroying the blood corpuscles and setting free anti-bodies. If so, a new principle in therapeutics has been established, namely, the introduction into the blood of a hemolytic agent. In the series of cases here reported 1 cc. of a 10 per cent solution of silver nitrate was mixed with 1000 cc. of water. Of this mixture 500 cc. was injected intravenously at a temperature of 110° to 115.° A chill, rise in temperature, marked drop in the leucocytes, followed by profuse sweating, were the phenomena observed in all cases. Several characteristic cases were reported. The first was a girl, aged sixteen years, suffering from streptococcus infection following an appendectomy. The usual surgical treatment did no good; the patient became extremely toxic, but following two injections of silver nitrate recovered completely. The second was a patient with a large peritoneal abscess, probably a general peritonitis. She was weak and irrational, and became rapidly worse in spite of treatment. The temperature had reached 104.° Silver nitrate was given three times, with the usual phenomena following. After each injection there was some improvement, and the patient was finally discharged well. Another case of streptococcus infection, very toxic and delirious, was similarly treated, and after the third injection made a perfect recovery. Ten cases of pyogenic infection have been treated by Dr. Hume with silver nitrate. He has had but one death, and that from intercurrent infection. No local results have been observed except two cases of mild phlebitis.

DR. OSLER.—I would like to ask, in view of these extremely good practical results, whether the treatment is of any value in cases of endocarditis, for silver has been recommended as giving good results in this disease, I believe.

I would also like to ask if it is not superfluous to open the vein for making these injections; is it not sufficient to insert the needle directly into the vein without an incision?

DR. HUME.—In most of the cases in which we have employed this method, the circulation has been so bad that even after lowering the arm over the side of the bed, the veins do not dilate enough to enable you to introduce the intravenous needle without making an incision and exposing the vein.

DR. THAYER.—Dr. Hume's observations are of great interest, more especially from a practical point of view. Why this procedure should be followed by favorable results, however, I cannot see. Theoretically, I cannot see why the destruction of red blood corpuscles or leucocytes should necessarily increase the resisting power of the organism. Certainly there can be no question of the production by such a method of specific anti-bodies.

Dr. Hume's results are interesting not only in themselves, but in the effect which they have produced upon those who have observed the cases. It seems to me, however, that further observations as well as animal experiment will be necessary before one can express a positive opinion as to the value of this procedure.

DR. GORTER.—In one of my cases of typhoid, Dr. Hume gave nitrate of silver as a last resort. It was apparently only a question of a few minutes before the patient must die, but revival occurred in the most wonderful way after the injection.

DR. COLE.—It is quite certain that the decision as to the value of this method of treatment must depend more on clinical observations than on any theoretical considerations. But in drawing conclusions from clinical observation, great caution must be observed. This is especially true in regard to streptococcus infections, for it is now known that many of these cases recover, even after a general invasion of the body, as shown by blood cultures, has occurred.

Bertelsmann (Arch. f. klin. Chir., Bd. 67) has published the results of bacteriological blood examinations in a series of surgical cases. Among his cases were 27 in which streptococci were demonstrated in the circulating blood during life, and of these cases, 19 recovered.

Among the cases of general streptococcus infections with recovery, occurring in this hospital, one treated during the past summer is of especial interest. This was in a young man admitted to the surgical service with a history of having been struck on the head by falling bricks five days before admission. Notwithstanding the fact that the scalp injury seemed trifling, the patient's condition had gradually grown worse. He complained of pain in his head, his temperature became elevated and he was therefore brought to the hospital. On admission his temparature was 106°, and, thinking that this might be due to an infection in the scalp wound, this was freely opened and swabbed with pure carbolic acid. His condition, however, did not improve. The temperature ranged between 102° and 105°, though the pulse rate remained about normal. He was then transferred to the medical side with a probable diagnosis of typhoid fever. The Widal test, however, was negative, and blood cultures showed the presence of *Streptococcus pyogenes*. The fever continued high for over two weeks. He was desperately ill, so that his life was despaired of, and we were about proceeding to some more active measures, such as that discussed by Dr. Hume, when, without any special treatment, the temperature began to fall, his condition improved and complete recovery followed. Blood cultures on three occasions showed the growth of a pure culture of *Streptococcus pyogenes,* so that there can be no doubt as to the diagnosis. There was no cardiac involvement and the Widal test remained persistently negative. This case well shows the danger of drawing conclusions from a few cases as to the efficacy of therapeutic procedures.

As to the theoretical considerations, while it has been demonstrated that so-called endo-complements play a part in the action of certain hæmolytic toxins, I know of no experimental basis, and none has been adduced, in support of the supposition that either bactericidal complements or immune bodies may be set free by the disintegration of red blood corpuscles. Moreover, it has been shown by Wassermann and Takaki (Berliner klin. Wochenschrift, 1898) that the immune bodies in typhoid fever take their origin in the lymphatic tissues of the body, so that in this disease, at least, the action of the silver solution, suggested by Dr. Hume and Dr. Pancoast, cannot play an important rôle.

Dr. Emerson.—The clinical side of the subject I am not qualified to discuss, but I would like to say a few words about the chemical action on the blood of the salt solutions, and especially since the previous speakers have brought the theoretical side of the question so much in the foreground. In the first place, there is really no danger that the salt solutions in common use are, because of their low percentage (0.6 per cent NaCl), dangerous. They are dangerous enough without this. While it is true that a solution of 0.9 per cent would more closely resemble the plasma, yet the plasma is hypertonic and the corpuscles are not laked in a watch-glass unless a solution below 0.4 per cent NaCl be used, and it is very doubtful if the blood can be laked within the vessels by the introduction of distilled water.

Again, the previous speakers seem to assume that the introduction of a dilute silver nitrate solution is about the same as if pure water had been used. But this is by no means the case; silver chloride is precipitated, but sodium nitrate is left in solution, and sodium nitrate is not a salt which will aid our friends' theory by causing hæmolysis, nor is it an indifferent salt; in fact, it may be even more beneficial than the sodium chloride which it replaces; at least Dr. Styles, in the Physiological Laboratory of this University, found a Ringer's solution made up with sodium nitrate superior in some ways to that with sodium chloride.

We much doubt, therefore, that hæmolysis has any part in explaining the beneficial results of the silver nitrate infusions. But if you could cause hæmolysis, it would be an event not without considerable danger. In fact, there is but one animal which would suffer worse than man from the potassium salts thus liberated, and that is the rabbit; in the dog the danger from this source is hardly one-twentieth as great; and potassium salts, Dr. Howell has found, have a very deleterious effect on the heart's action.

Lastly, judging from their leucocyte counts, we are told there occurs a destruction, then in a few hours a regeneration, of the white cells. But this is doubtful. This phenomenon—the drop and subsequent rise of leucocytes—has been observed long ago following the injection of various substances, and has been explained quite satisfactorily, first by Goldscheider and Jakob, as a redistribution of these cells; first they accumulate in the internal organs, then the depots of leucocytes in the bone-marrow empty out their cells and the count in the peripheral vessels rises. The formation of new leucocytes follows, but not soon enough to explain the leucocytosis our friends have observed.

Dr. Reik.—I have had the opportunity to observe the effect of this treatment in one case and must say that from the clinical standpoint it seemed marvelous. The case was one of thrombosis of the lateral sinus with general infection resulting from a chronic suppurative otitis media. A mastoid operation was performed and the septic clot removed from the sinus after ligation of the internal jugular. Metastatic abscesses appeared at various places and the patient's condition was so low that Drs. Finney and Pancoast, who saw the case in consultation with me, believed that death was imminent. At Dr. Finney's suggestion Dr. Hume was sent for, and he very kindly administered an intravenous injection of silver nitrate. This was performed about midnight, and when I saw the patient again on the following morning the transformation that had taken place was really startling. The temperature had dropped to normal, the patient was comfortable and cheerful and there was altogether the most remarkable change I have ever observed in any patient under any condition and within such a short time. The progress of this case was very satisfactory for some weeks, but the patient died later of an intercurrent affection.

Dr. Hume.—I would like to say that in presenting this theory I do not pretend to much knowledge concerning the action of silver nitrate in the blood, but only offer a possible explanation of the changes which take place. Practically I know that it gives results.

November 2, 1903.

The meeting was called to order by the President, Dr. Futcher.

Exhibition of Cases of Typhoid Meningitis. Dr. Cole.

Dr. Osler has asked me to speak to-night of a very interesting case of typhoid fever showing symptoms of meningitis, in which the diagnosis of typhoid meningitis was made by means of lumbar puncture during life. In connection with this case I wish to refer briefly to two other cases exhibiting somewhat similar features.

While nervous symptoms in typhoid fever are common, as the old term, "nervous fever," implies, meningeal symptoms are much less common, and of extreme variety are the cases of true meningitis during typhoid, especially those due to the typhoid bacillus.

The first case was a man aged 35, admitted to this hospital two years ago. The onset of the fever had been three weeks before admission and the course of the disease was uneventful up to the time of his entrance. On admission the patient was dull and drowsy, but not delirious, and there were no signs or symptoms of any meningeal involvement. The Widal test was negative, but the diagnosis of typhoid fever was made positive by the finding of typhoid bacilli in the blood by the method previously described (JOHNS HOPKINS HOSPITAL BULLETIN, Vol. XII, No. 124, p. 203). The day after admission the patient became delirious; a few days later he began having persistent nausea and vomiting. On the tenth day following his admission definite meningeal symptoms were noted. There was some retraction of the head and stiffness of the neck, the knee jerks were slightly exaggerated and there was a definite Kernig's sign. A lumbar puncture was performed and 30 cc. of clear fluid were obtained, in which no bacteria could be demonstrated on cover-slips and only a few polymorphonuclear leucocytes, but in the cultures made from this fluid there occurred a moderately profuse growth of typhoid bacilli. There was an improvement in the patient's mental and nervous condition following the lumbar puncture, but a few days later a profuse crop of boils appeared over the back, and these appeared in successive crops over the entire body, the patient gradually becoming weaker and weaker, until death occurred over a month later. This case is interesting and unusual, not only on account of the meningeal features, but from the fact that the typhoid fever terminated in a staphylococcus septicæmia, as was shown by the growth of Staphylococcus pyogenes aureus in cultures made from the blood on two occasions. Although there is a widely prevalent view, based mainly on the results of cultures made post mortem, that secondary infections during typhoid are common, out of about 150 cases of typhoid fever in this hospital in which cultures have been made from the blood during life, this is the only one in which such a secondary infection has been demonstrated.

The second case was a boy, aged 5 years. He entered the hospital after a six weeks illness associated with continuous fever and accompanied by a swelling and redness of the calf of the left leg. He was very sick on admission, was dull and apathetic, and was passing his urine and feces involuntarily. The phlegmon on his leg was opened and found to be quite superficial. On account of his general condition and the involvement of the leg a septicæmia or pyæmia was suspected, but the Widal test proved to be very positive. On the third day after admission there was noted some retraction of the head and stiffness of the neck and of the extremities. Lumbar puncture was performed and 20 cc. of clear, limpid fluid withdrawn. Only a few leucocytes could be demonstrated in the sediment. In the cultures made from this fluid, however, growth of Bacillus typhosus occurred. Following the lumbar puncture there was some improvement in the mental and nervous symptoms, but the other symptoms continued to grow worse and the patient died one week after admission. An autopsy was performed and characteristic lesions of typhoid fever were found. Permission could not be obtained for an examination of the brain, but a piece of the dorsal cord was removed. This failed to show any demonstrable pathologic changes.

The last case we have had under observation during the past few weeks. The patient was a colored boy, aged 15 years. The onset was with a chill, two weeks before admission. Following this he had a continuous fever and some cough, and two days before admission he became delirious and remained so up to the time of his admission. He was then in a muttering delirium and was very restless, occasionally trying to get out of bed. There was also some retraction of the head. It was thought probable that the condition present was one of general tuberculosis, with tuberculous meningitis. Accordingly a lumbar puncture was performed and 30 cc. of quite clear, colorless fluid obtained. No tubercle bacilli could be demonstrated in the sediment, but, staining with methylene blue, a few short bacilli were seen. Unfortunately, no cultures were made. A few days later the cultivation of typhoid bacilli from the blood gave the first conclusive evidence that the condition present was one of typhoid fever and not tuberculosis. The nervous symptoms became more marked, persistent vomiting occurred, and the retraction of the head and spasm of the extremities became extreme. A second lumbar puncture was performed, and this time the fluid was slightly turbid, and on holding it up to the light a distinct shimmer was seen. Under the microscope it was found that the turbidity was almost entirely due to large numbers of motile bacilli, resembling typhoid bacilli, which cultures later proved them to be. A few days later the patient began having some abdominal symptoms and the possibility of a peritonitis and the advisability of operation were considered, but on account of the patient's condition this did not seem advisable. He died on the following day. At autopsy the characteristic lesions of typhoid fever were found, and also broncho-pneumonia, acute cholecystitis and acute purulent cerebro-spinal meningitis.

NOTE.—The histological study of the brain and cord has not yet been completed, and this, together with a more detailed account of these cases, will be published later by Dr. McCallum and Dr. Cole.

All of these cases showed quite marked meningeal symptoms, and in all the typhoid bacilli were cultivated from the spinal fluid during life, but it must be remembered that only in the last one is there definite evidence of the presence of a true meningitis. Whether in the first two cases a mild meningitis was present, which in the first case disappeared (as did the symptoms, the patient living for almost a month afterward), or whether the invasion of the spinal fluid by these bacilli and their growing and producing their toxines in this medium may so affect the adjacent nerve cells as to cause the symptoms, is not certain. Cases of very mild early meningitis have been reported by Ohlmacher and Hofmann. On the other hand, the fact that typhoid bacilli have been found in the spinal fluid of these three cases of typhoid fever with marked nervous symptoms within a comparatively short time since we have made a routine of spinal puncture in these cases, makes it appear possible that mere invasion of the spinal fluid by these bacilli may be the cause of the marked nervous symptoms so frequently observed.

That a true suppurative meningitis may be caused by the typhoid bacillus, however, is conclusively demonstrated by the last case.

DISCUSSION.

DR. MACCALLUM.—In the case of which Dr. Cole has spoken, there was found at autopsy a fibrino-purulent exudate extending not only over the spinal cord but over the brain, being as usual especially abundant in the sulci. Microscopically, as in the case described by Ohlmacher, the most characteristic lesions are to be found on the vessel walls, where the endothelium is frequently lifted up by accumulations of cells which are sometimes so abundant as to completely obliterate the lumen of the vessel. These cells are apparently chiefly polymorphonuclear leucocytes.

There was in this case also an acute diphtheritic cholecystitis, with deep ulceration of the greatly stretched wall of the gall bladder. Although perforation had not actually occurred, there had apparently been an extension of the inflammation through the wall, for the surface of the gall bladder was covered with a fibrinous exudate. Although the bacilli which alone were present on the thin gummous contents had the appearance of typhoid bacilli, the cultures showed only colonies of colon bacilli.

DR. FUTCHER.—I think there is one lesson we have to learn in regard to these cases of typhoid fever with cerebral manifestations, and that is that whenever a patient with a continuous fever and marked cerebral manifestations, comes before one at this season of the year, the possibility of typhoid must be kept in mind. It is a case of this kind, particularly in the country where that possibility is not sufficiently recognized by physicians, that causes a great risk of infection to the surrounding country, by failure to disinfect the dejecta. The early symptoms of typhoid may very closely simulate those of a meningitis and the cerebral type of typhoid must be kept in mind.

The Late Effects of Typhoid Fever on the Heart and Blood Vessels. DR. THAYER.

(To appear in full in the Johns Hopkins Hospital Reports.)

DISCUSSION.

DR. EMERSON.—For some time I have been interested in the study of albuminuria and I have recently abstracted over 1000 of our hospital cases to get some idea of its occurrence. Since I noted the history of typhoid fever and the presence or absence of arteriosclerosis, it may be interesting to see what relation there is between these figures and those of Dr. Thayer. The first point to be observed was that I must exclude all cases of women, because in getting the age curve it differed so from that of the men that I could not arrange a satisfactory curve for arteriosclerosis. This left me 700 cases, and I count as negative all cases in which there was not a definite history of typhoid or a definite note in regard to the state of the arteries. The age periods used were from 1 to 15 years, 15 to 25, and from 25, in decades, upwards; this division was made because 15 is about the age of puberty and 25 represents the age at which the average man is of settled habits. In the first class, ages from 1 to 15, 9 per cent of the cases showed arteriosclerosis (I am now speaking without reference to typhoid); in the second class, 53 per cent; and in the third class, 62 per cent; from 36-45 years, 71 per cent; from 46-55, 75 per cent; from 56-65, 84 per cent; while at the age of 65 it has reached 100 per cent of palpable arteries. Now a study of the cases with a typhoid history shows, in the first period, none; in the second period, 80 per cent, a gain of 30 per cent; and in the third period, a gain of 10 per cent; at the age of 65 there is again 100 per cent of palpable arteries. In other words, the percentage of those with arteriosclerosis, in persons giving the history of typhoid fever, is in the different age periods from 10 to 50 per cent higher than among all persons having arteriosclerosis counted together, including the typhoids.

There is one point I would like to speak of that interested me immensely, and that is the fact that although typhoid seems to have such a deleterious effect upon the arteries, it does not have any such effect upon the kidneys. We should have expected that it would, because renal changes follow so closely upon the heels of arterial changes. Instead, however, there was, on the other hand, even a lower percentage of kidney trouble among those who had typhoid and arteriosclerosis than among those who had sclerosis without typhoid.

I hope that Dr. Thayer will also speak of the connection with aneurisms. If there can be one case with good evidence of a connection between typhoid fever and the production of aneurism it would be most fortunate for many patients. As it is now, when a young man comes in with an aneurism and denies a history of syphilis, no matter how positively he denies it, we suspect the truth of his statement. We should like to give him the benefit of the doubt.

DR. FUTCHER.—Our attention was called at the last meeting to the acute vascular complications that occur in connection with typhoid fever, in Dr. Steiner's paper, and Dr. Thayer at that time recalled the fact that we have had in our typhoid series, three cases of arterial thrombosis. I think the society is much indebted to Dr. Thayer for this careful piece of work, emphasizing as it does the fact that typhoid during the course of the illness apparently sets up changes in the arteries, that may result in very definite arterial thickening later on in life.

A Preliminary Report on a New Method of Treating Tinnitus Aurium. Dr. Reik.

I wish to make but a brief preliminary report at the present time, on some recent experiences in the treatment of that most troublesome symptom in ear diseases—tinnitus aurium—and to suggest a new therapeutic measure for its relief. You are probably all aware of the fact that the list of drugs recommended for the abolition of these distressing subjective sounds is already an unusually long one and not to be thoughtlessly increased, but the very fact that so many things have been proposed, and remain in use, indicates the unsatisfactory nature of the results obtained from their employment. The remedy that I shall ask you to consider in this connection is supra-renal extract and I was first led to use it, about six months ago, as a logical sequence of some experimental work that I had been conducting in the Physiological Department of this University. Before speaking of its practical application, it would be well, perhaps, to say something about the nature and mode of production of these subjective noises.

Tinnitus is defined as a ringing or singing sound in the ears. As a matter of fact, these subjective sounds vary greatly so that scarcely any two persons describe them in exactly the same way. They may be constant or intermittent and are always more or less annoying, sometimes extremely distressing, to the individual affected. They occur in about two-thirds of all cases of ear disease; being present in nearly all cases of acute or chronic catarrhal affections of the middle ear, many of the acute inflammatory conditions of the tympanum, some few of the chronic suppurative processes and, even in a number of cases of irritation of the external auditory canal as, for instance, where there is a mass of cerumen or other foreign body present.

Now the generally accepted explanation of their mode of production has been that the foreign body present in the canal or the inflammatory exudate in the tympanum produced a direct pressure on the tympanic membrane and ossicles, and thus indirectly through the foot-plate of the stapes upon the endolymph of the internal ear, and caused a simulation of the effect of a regular succession of sonorous waves upon the membrane. As you will readily see, this explanation is not an entirely satisfactory one. It may apply to a fair number of cases but there are unquestionably many cases of tinnitus where it would be impossible to prove and unreasonable to presume that any degree of increased intralabyrinthine pressure exists. Besides, in those cases where it may be assumed to have been present the tinnitus often persists long after every evidence of undue pressure upon the ossicles has been removed.

As the result of some experimental work which I have been permitted to conduct in the Physiological Laboratory, I am convinced that the proper explanation of the mode of production of tinnitus lies in an entirely different direction. I shall not attempt to review all of that work to-night but will simply say that animal experimentation has shown very conclusively that any irritation of the tympanic membrane or of the walls or contents of the tympanum will cause a marked vaso-motor disturbance and that this vascular change is invariably in the direction of vaso-dilation; that irritation of the sensory nerves of the tympanum produces a depressor, and not, as might have been expected, a pressor, effect. In the second place, these experiments have shown that any exudate into the tympanum, and here I tried to imitate the pathological conditions that exist in catarrhal affections of the ear, however small, will produce a like effect, and, that this vasomotor change commences with the entrance of the first particle of fluid introduced into the tympanum and before there can be any question of increased intra-tympanic or intra-labyrinthine pressure. It appears that irritation of the tympanum causes a dilatation of the small blood vessels of the middle and internal portions of the ear, and that the sounds produced by the increased flow of blood in the neighborhood of the delicate terminal filaments of the auditory nerve are sufficiently loud to be appreciated by the person so affected, and that sometimes they are sufficiently loud to be heard by the examiner.

Very naturally, if this be the proper explanation of the etiology of tinnitus aurium, the treatment should consist in the employment of some remedy that would tend to raise the blood pressure. Up to the present time I have experimented only with the extract of supra-renal gland, since that is to-day the most highly lauded blood-pressure-raising element. I first tried local applications but without effect. Then I began to administer the tablets or powdered extract, giving from one to two grains three times a day, and this met with more success. Together with the aid of my assistants in the Baltimore Eye, Ear and Throat Charity Hospital and in the Johns Hopkins Hospital Dispensary, I have now employed this treatment in a considerable series of cases but since these cases were all treated in the summer and fall months of a dry season, and the time elapsing since they came under observation has been so short, I am not yet willing to draw any conclusions as to the possible cures or the lasting effects of the remedy. I merely wish to call attention to the new theory, which I shall publish later in more detail, explaining the production of tinnitus, and to the logical conclusion drawn therefrom that tinnitus should be treated by such remedies as are caluclated to raise the blood pressure.

Exhibition of Appendices showing unusual Conditions. Dr. Burnam.

(To appear later.)

November 16, 1903.

The meeting was called to order by the President, Dr. Futcher.

Aneurism of Arch of Aorta and Innominate. Dr. Osler.

The first case illustrates some points in the symptoms of aneurism of the arch and the innominate artery. The patient was admitted on November 9 from Columbia, S. C. The family history is negative. In his personal history the one important item is that he had lues 8 years ago. He has been a temperate man except in the matter of eating. Two years ago the present trouble began with pain in the right shoulder, neck and arm, the pains being intermittent and lasting from one to two weeks. At the same time, he noted some puffiness of the feet and eyelids and he had a short hacking cough. The pain became more severe and was particularly bad in February, 1903. In June his voice became husky and in August there appeared a swelling above the manubrium and with the appearance of this tumor the pain and shortness of breath disappeared altogether. On September 23, after distal ligation of the right carotid artery, the tumor began to swell and in six hours, according to his statement, reached its present size. There has been no change in the condition since the operation.

The patient is a fairly healthy young man as you look at his face but as he sits up you see this large tumor mass in the neck reaching almost to the chin, obliterating outlines of the neck and projecting as a rounded ovoid mass fully the size of his fist, and on looking on it carefully you see that it pulsates. On palpation you can feel a very strong heaving impulse with the shock of the first and second sounds but there is no thrill. You can see that it is a large aneurismal sac that has come through the manubrium, has eroded the right sterno-clavicular articulation and has elevated the left sterno-clavicular articulation.

The point of interest is the statement that this large tumor appeared immediately after the operation upon the carotid. He thinks he had no swelling here before that time. The probability of course is that the tumor had already eroded the manubrium and the right articulation and while it was small before the operation of course it could not have eroded the bone in six hours and its sudden growth was simply the sudden expansion of the tumor sac shortly after its final rupture through the bone. I do not remember ever to have seen a reference to a very rapid development of the sac following ligation of the carotid.

The symptoms have been much relieved; he has no pain, shortness of breath or dysphagia but that is a very common result of the expansion of the sac in soft tissues. I would like to call the surgical student's attention to the excellent discussion of the symptoms and differential diagnosis between aortic and innominate aneurism in the new edition of Jacobson's Surgery.

Vasomotor Mottling.—Most of you have noticed that a baby's hands are not purely pink but usually pink and white, a mottled state, patches of hyperæmia, with others of a lighter color and some that are quite anæmic. This condition is also found in individuals who have an active cutaneous circulation; and it may be seen in young girls approaching puberty. In the cases before you the mottling of the skin is not pink and white, but blue and white, and this causes a peculiar appearance.

The patient came in a few weeks ago complaining of a peculiar numbness in the hands and feet. The trouble began in November, 1901, following a severe shock. It began in the left foot, then in the right and spread to the neck and arms. She complains now of numbness of the fingers. The greater part of both feet are bluish and in certain places cyanosed, but interspersed are pale anæmic cells. So intense is the coloring that you would think the blue spots were hemorrhagic; but the slightest touch obliterates them. The whole foot can be rendered anæmic by pressure and then the color very gradually returns. The mottling is also very marked over the lower part of the back. The impress of the hand on these livid spots is left in white and it is sometime before the color reappears.

She has improved somewhat under massage and cold packs, has gained in weight, the nervous symptoms have disappeared and she will probably get entirely well. Dr. Weir Mitchell, I believe, has reported a case very similar to this and I have no doubt there are others in the literature. In slight grades it is not uncommon in the hands and feet but so extensive an affection is rare.

A Case of Generalized Neuritis from Lead. Dr. Thomas

The patient, a man of forty-six, gave a marked alcoholic history, but the definite onset of his illness had occurred about two and one-half weeks after entering an enameling establishment. There was marked delirium at onset, increasing weakness, and some pain in the right shoulder. Distinct blue line in the gums, complete paralysis below the shoulder, absence of reflexes, slight dulness of sensation at the periphery, some muscle tenderness, granular degeneration of the red blood corpuscles, and an irregular temperature were the features of the case. General lead palsy is a rare condition, only about twelve cases having been reported in the literature.

Discussion.

Dr. Hurd.—It is interesting to notice that in cases of lead paralysis those muscles seem to be affected which are most used. Painters use their hands and wrists continually and the main effect of the lead poison is upon those muscles. In smelters where lead enters into the ores smelted and where the laborers use their arms mainly in shoveling it is found that the muscles of the arm are most affected, especially the deltoid.

In a case like this it would seem probable that alcohol had as much to do with the attack as lead because it is difficult to understand how such a tremendous effect could be produced by lead in two or three weeks time only.

A Case of Blastomycetic Infection. Dr. Gilchrist.

This is a very typical case of blastomycetic infection of the skin. The disease began several months ago on the right wrist as a small pimple which gradually increased in size. At one time as the lesion became larger it was mistaken for a ganglion and the attending physician tried to mash it with his thumb. Later it broke down and took the form of a papillomatous growth. This was followed by other lesions appearing on the wrist, the right thigh and the face. All the patches are distinctly papillomatous and the patient has always been able to squeeze out pus from between the papillae. The lesions itch very much and the patient soon found that by squeezing the pus out considerable relief followed. This mode of treatment caused some of the lesions especially those on the thigh and arm, to gradually disappear but those on the face did not succumb so readily and he presents now 9 or 10 lesions scattered over the face. They are superficial in the skin, rather dry, with sloping edges and distinctly papillomatous; and on squeezing, there exudes from between the papillæ a little, rather sticky, white pus from which a pure culture of the organism may be obtained. Here are specimens of the growths as they appear on agar and on glycerine-agar. The blastomycetes were easily found in the pus when soaked in liquor potassæ and they appeared as doubly contoured refractive budding bodies from 7-10 μ in diameter.

This disease, blastomycetic dermatitis, seems to be much more common in the United States than elsewhere. I have now had five cases under my care, but as many as 14 or 15 cases have been reported by Hyde and Montgomery of Chicago and scattered cases from New Orleans, Philadelphia, San Francisco, Canada, etc., have been reported, whereas only one case has been reported from Italy, one from Germany, one from England and one from the northern portion of India. This case forms a typical example of the affection and I shall pass photographs of three other practically new cases around showing the character of the disease. Section taken from a typical lesion of this patient shows benign hypertrophy of the epidermis, the presence of miliary abscesses in the epidermis and corium and pseudo-tubercles in the corium. Blastomycetes were found in the miliary abscesses in fair number. The disease has to be diagnosed from tuberculosis of the skin and from syphilis. Microscopic examination of the pus after soaking it in liquor potassa at once makes the diagnosis clear as the double contoured refractive bodies are usually easily found. The most satisfactory treatment is the free administration of potassium iodide which has a beneficial effect, even when it does not cure the condition. Lately, curetting and the X-rays have been tried with success.

Metabolism in Pregnancy. Dr. Slemons.

Dr. Slemons reported the results of studies made on four women whose metabolism was followed for about thirty-five days. The diet was carefully regulated and weighed; all the excreta (including urine, lochia, and milk) were carefully measured and daily estimates were made of the amount of urine excreted and the total nitrogen and ammonia output. The series showed a definite diuresis just before and just after delivery. All the cases showed a tendency of the mother to store nitrogen during pregnancy, and the case that bore live twins emphasized this tendency. The series also showed that during pregnancy there is a tendency for actual storing up of ingested fluid to take place. The ammonia excretion shows definitely that a fetus in utero causes changes in the mother's metabolism. It drops to normal after delivery and tends to become normal when the fetus dies in the womb. Relative suppression of renal activity explains the changes in the amount of excreted urine during and following labor. The diminution in nitrogen output is probably due to impairment of the kidney cells. The high ammonia output at the time of delivery cannot yet be explained. During the puerperium all the cases in Dr. Slemons' series showed a definite diuresis except the one that bore dead twins. There was a rise in the nitrogen output, usually beginning about the second day of the puerperium, and probably due to regressive changes in the mother. The ammonia fell gradually to normal. The series showed that metabolism tends to assume a non-pregnant type when the fetus dies in utero.

Discussion.

Dr. Hurd.—I think we ought to congratulate Dr. Slemons for the extreme industry and care which he has shown in doing this laborious piece of work and also for the clearness with which he has expressed his conclusions. We rarely have a paper presented to this Society showing such definite conclusions with such clear expression.

Dr. Emerson.—There are several points in connection with this paper which might pass unnoticed except by those who had already been at work in metabolism. Although work on this subject has been going on for about 60 years and it has been a favorite subject we have had but a small series of experiments reported showing the proper accuracy demanded by the scientific chemist and the physiologist. The debt of gratitude which Dr. Slemons has expressed to the nursing department is only just, as I can say from my own experience. We have here the co-operation of a nursing department, which is not only willing but able to do its part of the work, which is very trying at times, and it enables us to do the work here as it can be done in but few other institutions.

The four cases which Dr. Slemons has reported are very typical cases, have been studied with the greatest care over a sufficient length of time, by the best methods, and the results are both interesting and important. We congratulate him upon the work he has accomplished and are very glad that he chose the clinical laboratory as the scene of his work.

NOTES ON NEW BOOKS.

The Practice of Obstetrics. Designed for the use of students and practitioners of medicine. By J. Clifton Edgar, Professor of Obstetrics and Clinical Midwifery in the Cornell University Medical College. 1221 illustrations. *(Philadelphia: P. Blakiston's Sons & Co., 1903.)*

After carefully reading this profusely illustrated work of 1111 pages my first impression was one of disappointment, as I had

looked forward with great interest to its appearance, expecting that it would reflect the originality of its talented author. On the contrary, it differs but little from most of its predecessors, except in being abundantly illustrated and laying greater stress upon the necessity for asepsis and emphasizing the serious consequences of its neglect. A decided departure from the usual models is a section on rape and sexual hygiene, as well as a more extended consideration of ante-natal pathology and the diseases of the new-born child than is usually given in obstetrical text-books.

The book presents a number of serious defects, though it is a perfectly safe guide for both students and practitioners, especially so far as the practical side of obstetrics is concerned. In general it may be said to be open to particular criticism in four respects, namely; verbosity, absence of sound histological and pathological details, a distinct leaning to medical rather than surgical methods of treatment, and an almost entire lack of reference to authorities.

The work could have been condensed with advantage by several hundred pages, partly by the omission of certain subjects, but particularly by greater brevity and lucidity in description. Thus, in not a few places almost equal attention has been devoted to good, bad or indifferent theories or methods of treatment, thereby sometimes leaving the reader in doubt as to which is advocated. That the author was conscious of this defect is shown by the fact that he has thought it necessary to give a résumé or recapitulation of his views at the conclusion of a number of sections.

Another criticism is that not a few subjects are considered in a number of places. Thus, the treatment of occipito-posterior presentations is taken up under the mechanism of normal labor, dystocia from faulty attitude and obstetric surgery. Such repetition tends to make the subject less clear than if it were considered in its entirety in one place.

The work contains 1221 illustrations, many of which are excellent and original with the author and give evidence that great care and considerable thought was devoted to their preparation. Not a few, however, were taken from other sources, for which credit is usually omitted, thereby giving the impression that the author considers that the redrawing of an illustration entitles it to be classed as original. On the other hand, a considerable number are practically useless and could have been omitted with advantage.

A much more serious defect is the faulty description of many histological and pathological conditions. Thus, for example, the yellow color of the peripheral layer of the corpus luteum is attributed to the presence of hematin derived from the central blood clot, instead of to the characteristic pigment lutein, which is formed in the lutein cells before hemorrhage occurs.

The value of the book would apparently have been increased had greater attention been paid to illustrating the section on the placenta and its membranes. For example, there is no satisfactory illustration of the decidua, the only one given being one of Minot's showing the decidual cells of the compact layer. Nor are there any illustrations showing the minute structure of the chorionic villi, the character of whose epithelial covering is left to the imagination of the reader. If the book were scantily illustrated this would, of course, be a minor criticism, but in view of the abundance of illustrations, it would seem that attention could have been devoted to these subjects more advantageously than to some others which are profusely illustrated.

The pathology and history of deciduoma malignum, hydatidiform mole and placental infarcts are treated in an unsatisfactory manner, and the casual reader might readily obtain the impression that the hydatidiform mole is merely a myxoma of the chorion, instead of a complicated growth in which the chorionic epithelium plays a most essential and striking part.

The description of placental syphilis likewise leaves a good deal to be desired. The author does not believe that the changes in the villi are at all constant and that, therefore, their microscopic examination is of little value from a practical point of view. Personally my experience has been quite the contrary. Moreover, he holds that the most constant and characteristic lesion is the presence of gummata; a view which at present has few adherents, as most of the structures which have been described as such are merely infarcts in various stages of degeneration. He also believes that their presence predisposes to retention of the placenta and states that "the greatest maternal risk occurs at the time of labor from adherent placenta and subsequent sepsis." In several hundred syphilitic placentæ, I have never seen any evidence of gumma formation, nor have I noted any particular abnormality in the third stage of labor, but rather the reverse.

Eclampsia is classed among the diseases of the urinary tract, thus giving a false idea as to its nature. The author's views as to its pathology are extremely vague and are as follows: "The pathology of this condition is most obscure. Post-mortem examination of the organs shows general anemia, a congested cerebral cortex, now and then slight apoplexies of the liver and a fluid condition of the blood. It is interesting to note, however, that the most important alterations, decreased urinary toxicity and corresponding increase in the amounts of poisons circulating in the blood are found more strikingly intra vitam than after death." These statements reveal a surprising lack of respect for the work of Schmorl and his followers,who have shown that necrotic lesions of the liver, due to thrombotic processes originating in the periportal vessels, are the most striking manifestations of the disease. Likewise, the statements as to the toxicity of the urine and blood serum are not in accord with the views of most recent investigators, who have discredited Bouchard's work upon the subject and are inclined to attribute the supposed changes to bacterial contamination. While the author has accepted the toxemic origin of eclampsia in its entirety, it would seem that he has failed in great part to apply it to various other complications of pregnancy, such as uncontrollable vomiting and pernicious jaundice.

In the section on extra-uterine pregnancy the anatomical considerations are not in accord with the most modern teachings. Thus, the author considers that rupture is the most frequent termination of tubal pregnancy, and fails to mention the fact that recent investigation has shown that it occurs less frequently than tubal abortion, a condition to which he devotes only a single line. His description of the mechanism of rupture is likewise faulty, as he attributes it to injury of the chorionic villi, rather than to the occurrence of hemorrhage into tissues which have undergone degenerative changes as the result of the corrosive action of the fetal ectoderm. He likewise believes in the possibility of primary abdominal pregnancy, in spite of the fact that not a case has been described within the last ten or fifteen years in which satisfactory evidence has been adduced of such an occurrence.

In the section on the pathology of the puerperium, it is stated that super-involution of the uterus is an abnormal and very rare condition, thereby betraying ignorance of the work of Vineberg, Gottschalk and others, who consider it a routine phenomenon in every nursing woman.

It is unfortunate that so little stress is laid upon the bacterial origin of most cases of puerperal insanity, since cultures taken from the uterine cavity during the early stages of the affection almost uniformly reveal the presence of pathogenic bacteria, particularly streptococci. A little further on, it is stated that after pulmonary embolism, air embolism is the most frequent cause of sudden death during the puerperium. After discussing the matter in considerable detail, the author attributes it to the entrance of air into the uterine vessels and fails to mention that not a few competent observers are extremely sceptical as to the serious consequences of such an occurrence, since bacteriological examination has shown in a considerable number of cases that the air bubbles which were supposed to have been the cause of death were really the result of infection with *Bacillus aerogenes capsulatus.*

In considering the etiology of uterine rupture, it would seem that the author has devoted too little attention to the condition of the lower uterine segment and the epoch-making work of Bandl. Indeed, the anatomical considerations as to its production, in the section upon the changes produced in the maternal organism as the result of pregnancy, are neither as clear nor as full as might be desired.

The medical rather than surgical tendencies of the author may be made apparent by the following references. Thus, in the treatment of eclampsia he ardently advocates the use of glonoin and veratrum viride, while he speaks disparagingly of the benefits to be obtained from venesection and the infusion of salt solution. In fact, he appears to be guided by fear of criticism in the whole question of blood-letting, for in considering its advisability in the treatment of uncompensated cardiac lesions, he states that "venesection would often be useful were it not for its unfavorable moral effects."

Another and more serious manifestation of this tendency is shown by his advocacy of the induction of abortion in cases of absolute pelvic contraction, which he does not hesitate to recommend as an alternative for Caesarean section. In view of the present excellent results obtained by the latter operation, I consider that such treatment is unjustifiable and but little removed from criminal abortion, and hold that all such patients should be allowed to go to full term and then be delivered by Caesarean section, unless some complication threatening life should occur during pregnancy.

Likewise in considering the question of embryotomy he states that there still exists a very considerable field for the operation, and believes that in ninety-nine cases out of a hundred it would be chosen by the family in preference to Caesarean section. It appears to me, however, that such a decision would not be made if the obstetrician felt himself to be a competent operator and placed the merits of the two operations in their true light, as I know from my own experience that the average patient and her family will follow whatever advice may be given, provided they have confidence in their adviser.

Moreover, the author overestimates the innocuousness of embryotomy, stating that in his experience of six cases it was without mortality whereas Bar and Pinard with a far greater experience show that it is not without considerable danger. He likewise gives a false impression as to the relative merits of the two operations by devoting eighteen pages to the consideration of the various methods of embryotomy and only eight to Caesarean section, which might lead unthinking students to believe that the former was usually the operation of choice. This impression is strengthened in the section on Caesarean section, in which considerable space is given to the consideration of the lowest conjugata vera in which embryotomy is feasible, cases being cited in which it was successfully effected in pelves measuring only one and a half inches (3.8 cm.), while the actual indications are considered very briefly. At the same time he states that Caesarean section is always a dangerous operation, and fails to refer to recent statistics which show the very satisfactory results obtained by experienced operators.

It is gratifying to note that the author is not enthusiastic concerning the merits of symphseotomy; although decided exception must be taken to one of his indications, namely: "When the child cannot be born alive, symphseotomy may be conjoined with a mutilating operation even with a conjugata vera as low as 2.13 inches (5.4 cm.)." This is extremely unfortunate advice, as the only justification for the former operation is the hope of saving the child, and recourse to embryotomy simply means that one has attempted symphseotomy under conditions in which it is not considered called for even by its most enthusiastic advocates.

While my criticisms may appear somewhat harsh, I am glad to say that they apply only to a small portion of the work, as in many other respects the surgical recommendations are the most excellent and are in accord with the best teachings. Thus, he is an enthusiastic advocate of laparotomy in extra-uterine pregnancy and rupture of the uterus, but is very conservative concerning its value in puerperal infection. Moreover, his views as to the methods of inducing labor and bringing about *accouchement forcé* are most satisfactory, in that he justly lays great stress upon the necessity of the internal os being obliterated before the latter becomes a safe procedure. He holds that manual is superior to instrumental dilation, even with Bossi's instrument.

His views as to the employment of version and forceps are in general most excellent, although in the latter operation he does not lay sufficient stress upon the advantages of the cephalic application, and while admitting that it is usually the ideal method, he nevertheless describes the pelvic application first, thereby giving the impression that it is to be employed by preference. His views as to the employment of the forceps as a rotator in posterior positions of the occiput are quite correct, though I cannot subscribe to his advice to deliver with the forceps inverted after rotation. Nor can I understand why he recommends its oblique application in deep transverse positions of the occiput, when its adaptation to the sides of the head is quite as readily effected and is attended with most excellent results.

Another great lack in the book is the almost complete absence of reference to the history of obstetrics and to the men who have made it what it is, and it would seem that a student whose instruction had been obtained solely from this source might be almost entirely ignorant of the work of the great fathers of our art. In making this criticism, I, of course, do not claim that such knowledge is necessary to make one a competent obstetrician, but at the same time it must be admitted that ignorance in this respect is to be regretted, as it tends to make the student feel that all knowledge is of comparatively recent origin; whereas many of the older men did work of which we might be justly proud at the present time. Had this course been adopted in American text-books in the past, it is not likely that we should have seen a number of competent obstetricians describe as original the method of applying the forceps in posterior positions of the occiput, which Scanzoni advocated more than fifty years ago.

In this connection it would appear that the author himself seems to attach but little importance to such details, as he describes the Mauriceau method of extracting the after-coming head as "jaw and shoulder traction, or method of Smellie-Veit or Mauriceau method," thereby giving the impression that Smellie and Veit had invented it, instead of Mauriceau; whereas the latter had described it more than fifty years before Smellie's time, while Veit's connection with it was simply to bring it to the attention of his German confréres.

It might appear from the foregoing that I have nothing but fault to find with the book under review, but such is not the case, as in many portions it is extremely valuable. Thus, the section upon the changes in the maternal organism resulting from pregnancy leaves nothing to be desired, with the single exception of the consideration of the contractive ring. Likewise the section upon the fetus and the mechanism of labor is most excellent, and not a few of the pictures accompanying it are real contributions to the subject. The same may be said of the section on the normal puerperium and the care of the woman and child immediately following labor. The section on puerperal infection is likewise well written and based upon sound teaching and practice. With the exception of the objections already taken, the section on obstetric surgery is extremely good, and my only criticism is that relatively more space has been devoted to minor than to major operations. J. Whitridge Williams.

A Text-Book of Obstetrics. Fourth Edition, enlarged and thoroughly revised. By Barton Cooke Hirst, M. D., Professor of Obstetrics in the University of Pennsylvania. Handsome octavo, 900 pages, with 746 illustrations, 39 of them in color. (*Philadelphia, New York, London: W. B. Saunders & Co., 1903.*)

This, the fourth edition of Dr. Hirst's text-book, contains a number of new illustrations from his recent work on Gynecology and many from the more recent German works; the latter, though excellent, represent the woman in the dorsal position for delivery, and some of the maneuvers depicted are quite impossible with the patient in the left lateral position as advocated by the author. The alterations in the text are comparatively slight, though references have in some instances been added for material present in the earlier editions. The old arrangement whereby abortion, intra-uterine pregnancy, etc., are considered before normal labor, and the management of labor before its mechanism, it still adhered to. The exhaustive index is of great value to the reader. From the standpoint of completeness and reference to original authorities the article on puerperal sepsis stands out prominently, and it is surprising to find, after an excellent résumé of the work on the bacteriology of puerperal fever, that no practical use is made of the evident deductions. Routine examination of the lochia of febrile patients is not encouraged. The author believes that "while such an examination is always interesting, it is not always of great practical value from the diagnostic point of view. It might indeed be distinctly misleading" (p. 716). The pathological anatomy is but briefly considered, and the general treatment recommended is the administration of large doses of quinine "to combat a possible malarial infection" and the routine use of the curette accompanied by one or more flushings of the uterine cavity with 1-2000 bichloride solution. The author has in this edition so far recognized the opposition to this procedure that he advises "care . . . to scrape the walls lightly so as not to penetrate the layer of granulation cells under the endometrium." Laparotomy in puerperal sepsis is advocated with rather broader limitations than has been usually accepted; and in this, as elsewhere, the personal experience of the author is the basis of his judgment. The book contains much practical general advice.

A Text-Book of Obstetrics. By J. Clarence Webster, M. D. (Edin.), F. R. C. P. E., F. R. S. C., Professor of Obstetrics and Gynecology in Rush Medical College, in affiliation with the University of Chicago. 383 illustrations, 23 of them in colors. (*Philadelphia, New York, London: W. B. Saunders & Co., 1903.*)

The book is well arranged and neatly printed. Heavy type marks the beginning of each topic and would offer considerable facility in the use of the volume for reference, were not many of the subjects too scantily treated to make the book valuable in this respect. The text abounds in the mention of those who have made contributions to the various sides of obstetrical science, and it is to be regretted that the author has not made his wide reading available for others by appending a bibliography to each chapter.

No consideration of the anatomy of the normal female is supplied. The book opens with the conventional description of the ovum and passes at once to the subject of placentation. This is treated clearly, but too dogmatically, the author's own views frequently taking the place of a fair statement of all sides of a question concerning which authorities differ and where the present state of our knowledge leaves much room for doubt.

The anatomy of pregnancy, labor and the puerperium is better given than in any other text-book written in English. The author's own frozen sections and his study of the reports of others have enabled him to make a presentation of this subject which will repay careful reading.

The abnormal conditions which the obstetrician may be called upon to treat are enumerated at great length and are usually defined with a clearness that is characteristic of the author's style. The pathological and clinical descriptions are meagre. Therapeutic measures are extensively catalogued but without discrimination. The author fails to emphasize the important ones or to condemn the useless ones and rarely states what mode of treatment he has found most satisfactory.

It is surprising to find the author clinging to the pelvic method of application of forceps. Perhaps a little more time and a much better knowledge of obstetrics will be required to apply the blades accurately to the sides of the child's head, but there is ample reward for care in the lessened danger of injury to the mother and to the child.

To hold out anything but the highest ideals to students is surely a mistake. To teach beginners to use forceps with any less information than a painstaking diagnosis can afford, will sometimes lead to loss of life that might be averted. A textbook which not only fails to describe the cephalic method, but merely mentions it for condemnation as ridiculous, is unsafe to place in the hands of men who will rely upon it as their sole source of information.

Tumors, Innocent and Malignant. By J. Bland-Sutton, Surgeon to the Chelsea Hospital for Women; Assistant Surgeon to the Middlesex Hospital, London. Third edition. (*Chicago: W. T. Keener & 1903.*)

An extensive review of a work so well and favorably known is unnecessary; however, it might be of interest to mention some of its features.

Excluding those formations known as the infective granulomata, the author arranges tumors in four groups; (1) connective tissue tumors, (2) epithelial tumors, (3) dermoids, (4) cysts.

The subject of sarcoma of bone is well presented. The myelomata are separated from sarcomata and considered in an interesting chapter. This distinction is of importance from the standpoint of their surgical treatment.

The chapters on uterine fibroids have been enlarged and the pathological side of the subject is thoroughly discussed. The chapter on echinococcus colonies has been restored. The chapters on malignant growths of the kidney are well worth reading. In discussing sarcomata of this organ the author mentions their peculiar age distribution, usually their liability to occur in the first five years of life and after thirty years of age.

Probably the most interesting passages in the book are those dealing with the homology of certain tumors and malformations, the occurrence of osteomata in certain fishes, mandibular tubercles in dogs, cervical auricles in goats, bronchial fistulæ in sheep, cutaneous horns in mice, etc.

The important subject of carcinoma of the breast does not receive the careful consideration that it deserves.

The descriptions of the distribution of tumors and the illustrations of their gross appearance are very numerous and very good, but the same cannot be said of the descriptions of their gross and microscopic appearance and the illustrations of the latter. S. H. W.

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THE RELATION OF LEUCOCYTES WITH EOSINOPHILE GRANULATION TO BACTERIAL INFECTION.[1]

PRELIMINARY PUBLICATION.

By Eugene L. Opie, M. D.

Associate in Pathology, Johns Hopkins University; Fellow the Rockefeller Institute for Medical Research.

(From the Pathological Laboratory of the Johns Hopkins University and Hospital.)

Certain bacteria (Bacillus tuberculosis, Bacillus choleræ suis) producing somewhat chronic, fatal infection in guinea pigs, cause the eosinophile leucocytes to disappear gradually from the circulating blood. After death few eosinophile cells can be found in those tissues in which they are usually present in abundance. Hence the study of tissues removed at autopsy gives little indication of the behavior of the eosinophile leucocytes during the course of bacterial infections. During more acute infections produced by inoculating bacteria into the peritoneal cavity of guinea pigs (Bacillus mucosus capsulatus of Friedländer, Bacillus pyocyaneus, Streptococcus pyogenes) eosinophile leucocytes quickly disappear almost completely from the peripheral circulation.

After the inoculation of an organism (Bacillus pyocyaneus), producing an infection from which the animal is capable of recovering, eosinophile leucocytes almost completely disappear from the peripheral circulation so that within twenty-four hours the proportion may fall from five or ten per cent to less than one per cent. The number of eosinophile leucocytes then gradually increases and at the end of four or five days both the relative and absolute number of these cells may considerably exceed that present in the peripheral circulation before inoculation. At the end of six or seven days the number of eosinophile leucocytes is again normal.

When bacteria (Bacillus pyocyaneus, Bacillus mucosus capsulatus, Bacillus anthracis) are introduced into the peritoneal cavity of the guinea pig, the large mononuclear and eosinophile cells contained in the peritoneal fluid form compact clumps which adhere in great part to the surface of the omentum, so that for a time eosinophile cells have almost completely disappeared from this fluid. At the end of about an hour they have again made their appearance. Some of the eosinophile cells normally present in the tissues of the mesentery and omentum doubtless make their way into the cavity, but soon eosinophile cells begin to accumulate in the blood vessels of both membranes, but particularly in those of the mesentery. These cells adhere to the wall of the small veins and migrate into the surrounding tissue. This process begins about one hour after inoculation, reaches its maximum several hours later and is more marked the larger the quantity of bacteria introduced and the more virulent the organism employed. At the end of about four hours when the number of eosinophile leucocytes in the peripheral circulation has undergone well marked diminution, the same cells have accumulated in great number in the vessels of the inflamed mesentery and omentum. Similar changes are much less marked below the peritoneum of the abdominal wall and below the serosa of the viscera. Though eosinophile cells are migrating from the blood vessels into the peritoneal cavity their relative number in the peritoneal exudate diminishes and at the end of four hours is only one or two per cent. Polynuclear leucocytes at this time have accumulated in such immense number that they constitute an overwhelming proportion of the cells present.

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[1] Read before the Johns Hopkins Hospital Medical Society, March 7, 1904.

Eosinophile cells are present in the cavity at the time of inoculation but only after a period of about an hour do they begin to accumulate in increasing numbers. A primary attack of eosinophile cells directed against the inoculated bacteria, such as that described by Kanthack and Hardy, has not been observed. Polynuclear leucocytes with fine granulation accumulate in great quantity upon the surface of the omentum and form compact clumps held together by a network of fibrin; eosinophile leucocytes in large number penetrate into these masses of cells. Unlike the polynuclear leucocytes eosinophile cells rarely, if ever, acting as phagocytes, ingest bacteria.

Eosinophile leucocytes upon the surface of the omentum, doubtless under the influence of bacterial poisons, undergo degenerative changes of which nuclear fragmentation is the most characteristic. In such cells the eosinophile granules are still preserved. Evidence that the cells discharge these granules has not been obtained. At a somewhat later period eosinophile leucocytes are ingested by large mononuclear cells (macrophages).

Under the influence of severe bacterial infection eosinophile myelocytes together with other elements, usually regarded as characteristic of the bone marrow, accumulate in the spleen and may be found in the blood. The occurrence of this phenomenon within from two to four hours after inoculation demonstrates that these elements are derived from the bone marrow and are not formed in the spleen. Myelocytes, both with fine and with coarse (eosinophile) granulation, which have found their way to the spleen, here multiply by karyokinetic division.

The foregoing observations demonstrate that eosinophile leucocytes have a part in the inflammatory reaction which follow the entrance of bacteria into the body. They are attracted from the blood to the site of inoculation and from the bone marrow into the blood. Destruction of eosinophile leucocytes results and is followed by regeneration.

DISCUSSION.

DR. FUTCHER.—I wish to ask Dr. Opie if he thinks these reactions in the bone marrow are due to the effect of toxines? Whether more toxines stimulate the activity of the bone marrow and an increased amount of it, or a more severe infection, causes a loss of function of the bone marrow?

DR. OPIE.—I see no other way to explain the multiplication of eosinophile cells and the degenerative changes which they undergo unless it is assumed that the parasite produces a soluble toxine. It might be suggested that the presence of the parasites themselves in the lymph glands and in the lungs could cause an accumulation of these cells; certainly this explanation is not applicable to the degenerative changes found in the bone marrow. There is no reason to believe that the parasites accumulate in the marrow, and indeed there are here no foci which may be somewhat inaccurately designated eosinophile abscesses. The observations of Calamida give evidence that there are soluble toxines in the bodies of certain animal parasites capable of causing multiplication of eosinophile cells; increase of eosinophile cells was produced with an extract that had been passed through a Pasteur filtre. My experiments with such extracts were not conclusive and did not disprove his observations. I discarded this means of increasing the eosinophile cells simply because it was difficult to obtain suitable material.

THE RELATION BETWEEN CARCINOMA CERVICIS UTERI AND THE URETERS, AND ITS SIGNIFICANCE IN THE MORE RADICAL OPERATIONS FOR THAT DISEASE.

By JOHN A. SAMPSON, M. D.

Resident Gynecologist, The Johns Hopkins Hospital. Instructor in Gynecology, Johns Hopkins University.

The treatment of any disease should be based on a knowledge both of the normal anatomy and physiology of the parts involved and also of the pathological changes in these parts as brought about by the diseased condition. On the other hand one must recognize the importance of clinical experience and that the course of treatment indicated as a result of laboratory and experimental work, may be too severe or in other ways inapplicable to human beings.

Many things must be considered in the operative treatment of carcinoma cervicis uteri. The importance of an early diagnosis is well known by many, but the difficulty comes in making the diagnosis, for frequently there are not any symptoms referable to the disease until after the growth has extended beyond operative treatment. On the other hand, the diagnosis may be evident from the first, and patients are treated for months by their physicians with medicine and local applications until the "ulcer becomes cancerous." The result of the above is that about three-fifths of the patients who have entered this hospital suffering with cancer of the cervix, come too late for anything but palliative treatment. This condition can only be improved by impressing upon the medical profession the importance of an early diagnosis, and by having such laws regulating the practice of medicine that only those may practice who are able either to recognize that such a condition exists, or, if in doubt, will undertake measures to determine the exact cause of the trouble.

Granted that the only hope for a cure is in the removal of the growth; the next question which presents itself is, how can it best be done? Here the results of the study of the normal and pathological anatomy of the parts concerned must be combined with those of clinical experience.

Clinical experience has taught all who have studied the situation, that the operative treatment of this disease is far from being satisfactory. In this hospital we are confronted with a primary mortality of 16. + per cent, and only about 12 per cent were free from recurrence after a period of five years (Oct. 02). There have been 63 vaginal hysterectomies, with 5 deaths; 26 combined abdominal and vaginal hysterectomies, with 5 deaths; and 67 abdominal hysterectomies, with 16 deaths. The comparison of the percentage of cures and also the primary mortality in these three classes of cases is of no value, for the abdominal or combined abdominal and vaginal operation have in many instances been used instead of the vaginal operation because the growth was too far advanced for the vaginal route. It can never be hoped that the abdominal operation will be attended with as low a primary mortality as the vaginal; on the other hand, by the vaginal route the wide excision of the parametrium and pelvic lymph nodes is impossible. Whether one shall employ the vaginal route or the more radical abdominal operation in these cases, cannot be determined from statistics, for sufficient time has not elapsed since the use of the more radical abdominal operations to furnish enough cases to compare with those removed by the vaginal route.

Olshausen[1] has recently endeavored to compare the results of the two methods of operating and concludes that for the majority of cases he prefers vaginal hysterectomy. He states that he has had 671 cases, of which 31.6 and 44 per cent (two periods), were operable, with a primary mortality of 6 per cent; 74 per cent of the cases operated upon were free from recurrence at the end of two years and 38.8 per cent at the end of five years. He compares these with Wertheim's 120 cases, of which 40.3 per cent were operable, with a primary mortality of 20 per cent and 77 per cent free from recurrence at the end of two years. Five years have not elapsed since Wertheim's first cases were operated upon, so one has no way of comparing the results at the end of this time. Our results with only about 12 per cent free from recurrence at the end of five years as compared with Olshausen's 38.8 per cent, can only be explained on the ground that in the patients who were operated upon by him the growth was limited to the uterus in more instances than in our cases. The most ardent supporter of the vaginal route must admit that only those cases can be cured by a vaginal hysterectomy in which the growth is limited to the uterus. *Even Olshausen states that it is advisable to use the abdominal route in those cases in which the parametrium is involved, so that the ureters may the more safely be dissected from the cancerous tissue.*

Could one operate on cases before the growth had extended into the parametrium, then the vaginal operation would be the operation of choice, as it is the one attended with the lowest primary mortality. In view of the fact that clinical experience can count for so little, the decision as to the choice of an operation must be based on a study of the parametrium and the pelvic lymph nodes in the so-called operable cases.

Over a year ago I[2] called attention to the importance of a more radical operation as based upon the findings in the parametrium in these cases, and emphasized that it is impossible to clinically diagnose the presence of cancer in the parametrium for it may exist in minute parametrial lymph nodes which may have a diameter of not over 1 to 1.5 mm. and so cannot be palpated even after the growth has been removed. So it would seem that the more radical operation was indicated most in the so-called favorable cases, for in these there is the greatest chance for a cure.

Kundrat[3] has recently published the result of his studies of the parametrium in 80 of Wertheim's cases. An idea of the thoroughness of the work may be gained from his statement that he studied over 21,000 sections. In 44 of the cases the parametrium was found to be involved by the cancerous growth. He emphasizes that the presence of cancer in the parametrium can only be diagnosed by the use of the microscope, for an infiltrated condition of the parametrium is not necessarily carcinomatous and a natural feeling parametrium does not exclude cancer, a point which has been previously emphasized by Wertheim.[4] There is also no relation between the size of the primary growth and the cancerous involvement of the parametrium, for the primary growth may be very large and yet the parametrium may be free from cancer; on the other hand, the primary growth may be very small and the parametrium may contain carcinoma. He calls attention to the frequency of metastases to the parametrial lymph nodes as this occurred in 15 instances.

Of great significance is the relation of the involvement of the parametrium to the involvement of the pelvic lymph nodes in these 80 cases. In 32 of the 80 cases both the parametrium and the pelvic lymph nodes were apparently free from cancer. In 22 cases the parametrium was found to be cancerous, while the pelvic lymph nodes were uninvolved. In 18 cases, both the parametrium and the pelvic lymph nodes were involved by cancer. In 4 cases the parametrium on both sides was free but the pelvic lymph nodes of one side were cancerous, while in 3 other cases the parametrium of one side was cancerous and the lymph nodes of the opposite side, and in another instance only the parametrium on one side was cancerous while the pelvic lymph nodes on both sides were involved. This latter group showed that apparently in 8 instances the growth was able to pass through the parametrium and reach the pelvic lymph nodes without the former becoming involved, while in 22 cases the parametrium was able to prevent the further spread of the disease. In other words, in 22 out of 48 operable cases in which the disease had extended beyond the uterus (for in 32 cases it was apparently limited to the uterus), the parametrium was able apparently to check the further extension of the disease, and in addition in 22 of the remaining 26 cases, the parametrium was involved as well as the pelvic lymph nodes, thus showing that the parametrium was involved in 44 of the 48 operable cases in which the growth had extended beyond the uterus. In 26 of the 80 cases the pelvic lymph nodes were involved and in 22 of these 26 cases the parametrium on one or both sides was also involved. It becomes very evident from Kundrat's work alone that the only operation justifiable is one which will permit of a wide excision of the parametrium, and this is impossible in the vaginal operation.

Wertheim,[5] realizing the importance of a wide excision of the parametrium and also of the removal of the pelvic lymph nodes, dissected the ureters free and after removing the uterus with as much of the parametrium as possible, the lymphatics were removed from the sides of the pelvis. The ureters were thus out of harm's way, but ureteral necrosis was apt to occur. In order to avoid ureteral necrosis a change[6] was made in his operation. Instead of dissecting the ureters free the parametrium was removed mesial to the ureters so as not to injure arteries which approach that portion of the ureter from the sides of the pelvis, as has been described by Feitel.[7] As a result, ureteral necrosis occurred in only two instances in his next 30 cases, as compared with 5 cases, 3 of which were double, thus making 8 instances in the previous 30 cases. In these 2 cases in which it occurred, the growth was adherent to the ureter and it became necessary to dissect the ureter free, and necrosis resulted.

It must be conceded that hysterectomy alone cannot cure the disease but that there must be a wide excision of the parametrium in order to get outside of the growth in over half of the cases, and again the pelvic lymph nodes must be removed for they are involved in at least 30 per cent of the operable cases. The greatest obstacle to the wide excision of the parametrium is the ureter, for it passes through the tissue which should be removed.

The indications for the treatment of the lower ends of the ureters must come from a study of the parametrium about the ureters in the so-called operable cases, combined with what may be learned from clinical experience. The justification of any course of treatment suggested from the above, must be tested by the results of anatomical studies, experiments on animals, and finally, clinical experience.

Clinical Manifestations of the Relation Between Carcinoma Cervicis Uteri and the Ureters.

Clinically, the relation between cancer of the cervix and the ureters manifests itself in two ways.

First, in the more advanced stages of the disease the extension of the growth out into the parametrium, soon reaches the ureter and that duct becomes compressed, resulting in renal insufficiency, and one may find reported in the literature various palliative operations in order to relieve this condition; as, nephrotomy, bringing the ureter out on the skin, and also resecting and reimplanting the ureter into the bladder above the growth.

This relation manifests itself, secondly, in the frequency of accidental injuries to the ureter in hysterectomy for carcinoma cervicis uteri. When the parametrium is apparently involved by the carcinoma and the surgeon desires to get outside of the growth, unless great care is taken, one or both ureters may be injured. Since the opening of the Johns Hopkins Hospital in August, 1899, until January 1, 1904, there have been admitted to the gynecological department of the hospital 10,961 patients. Of these, 8,590 have undergone some sort of an operation. There have been 4,669 major operations, which term includes all cœliotomies, both abdominal and vaginal, and all operations on the kidney. There have been 31 cases of accidental injury to the ureter, not counting cases in which a portion of the ureter has been intentionally excised, and only one of these occurred in a minor operation, and that was the ligation of the ureter in repairing a vesico-vaginal fistula. Of these 31 cases, 19 have occurred in hysterectomy for carcinoma of the cervix. The relation between this operation and injury to the ureter becomes still more evident when one considers that there have been 19 cases of injury to the ureter in 156 hysterectomies for carcinoma of the cervix and only 11 cases of injury to the ureter in 4,513 other major gynecological operations. These injuries have been of various kinds; as, ligating, clamping, cauterizing, cutting and interferring with the blood supply of the ureter so that necrosis occurred, with a resulting uretero-vaginal fistula. Some of these injuries were recognized at the time and repaired, while others were not discovered until afterwards. The cases of accidental ligation and clamping of the ureter have been published.[8]

The compression of the ureters by an extension of the growth and the large number of accidental injuries to the ureter occurring during hysterectomy for cancer, results from the proximity between the cervix of the uterus and the ureters and from the fact also that this relation may be distorted by pathological conditions and by certain steps in gynecological operations.

Anatomical Relation Between the Cervix of the Uterus and the Ureters.

In 1869 Freund and Joseph[9] described the normal relation of the ureters to the various structures in the pelvis and stated that the course of the two ureters is not symmetrical but that the left ureter is nearer the middle line, and as a rule nearer the uterus and its cervix than the right ureter. They stated that where the ureters cross the common iliac arteries they are 5.7-7 cm. from each other and from there follow the curve of the pelvis, and 2-3 cm. below this point the distance between them increases to 10-13 cm. They now begin to gradually converge, and at the level of the internal uterine os are 9.8 cm. apart, from which point they converge so rapidly that in the course of some 4-4.5 cm. to their orifices into the bladder, the distance between them is diminished to 2.7-3.5 cm. At the level of the external uterine os the distance between the ureters and the cervix is given by them as 2.5-3.3 cm. for the right and 1.5-2.7 cm. for the left ureter. Luschka,[10] in an article on the topography of the ureters in women, states that at the level of the internal uterine of the os the ureters are 2.5 cm. from the cervix, while near the supra-vaginal portion of the cervix they are 8 mm., and at the vaginal vault 6 mm. from the cervix of the uterus. Ten years later Holl[11] reviews the entire subject again and emphasizes that the relation between the cervix and the ureters is asymmetrical and that the distance is usually less on the left side than on the right and also that this relation may be distorted by displacements of the uterus.

During recent years many writings bearing on the topography of the ureters in women have appeared from various sources, and especially instructive are those in which the findings are based from cross sections made of female pelves, thus demonstrating the relation between the ureters and the cervix at the different levels. Such illustrations may be found in Waldeyer's[12] Das Becken and in the Atlas of Tandler and Halban,[13] the latter showing the relation of the female ureters to other pelvic structures, especially in pathological conditions and gynecological operations. Plate No. III of the above-mentioned atlas was made from a cross section of the hardened pelvis of a virgin, seventeen years old, taken at the level of the ureteral orifices in the bladder. In this instance the uterus was in the left side of the pelvis and one finds that at this level the left ureter is but 5 mm., while the right is 2.5 cm. from the cervix. See Fig. II.

Through the kindness of the anatomical department of the Johns Hopkins Medical School, I had the opportunity of studying the anatomical relation between the uterus and the ureters in a multipara with adherent retroposition of the uterus, in the right side of the pelvis. The subject was preserved by injecting formalin through the femoral artery. An attempt was made to inject the arteries with plaster of Paris colored with ultramarine blue. This did not prove to be very satisfactory as the mass became hard before reaching the smaller arteries. The subject was frozen and the pelvis was sawed in serial cross sections. The angle at which these sections were cut is shown in Fig. I by the line b-b which also represents the position of the section from which Fig. IV was drawn and its relation to the horizontal plane of the body represented by the line a-a. In Fig. III, which was drawn from a section cut about 1.5 cm. above the symphysis and 1.5 cm. below the tip of the coccyx, and cutting the head of the femur at a higher point on the left than the right side, the cervix is cut across a little over 1 cm. above the external os. In this drawing the close relation between the uterus and the ureters can be seen, and in this section the right ureter is but 3 mm. distant from the vaginal wall, and its orifice in the bladder is situated directly in front of the mid line of the cervix. See Fig. V. The distance between the vaginal wall and the left ureter is 8 mm. in this section and its orifice is situated lateral to the cervix, as shown in Fig. V. The asymmetrical relations between the cervix and the ureters, caused by the uterus being in the right side of the pelvis, is again brought out in Fig. IV, which is situated a little over 1.5 cm. above the section represented in Fig. III. In this section the right ureter is but 8 mm. from the cervix, as contrasted with a distance of 3.5 cm., i. e., over four times as great, which separates the left ureter from the cervix. From these sections I reconstructed the relation between the ureters, uterus, rectum and sacrum and coccyx. Fig. V is a drawing representing this reconstruction and as shown in this drawing the course of the ureters, as far as the fixed structures of the pelvis are concerned, as the sacrum and mid line, are practically symmetrical, but their relation to such movable structures as the rectum and uterus is dependent on the position of these structures in the pelvis, and in this case the close proximity of the right ureter to the uterus is dependent not on the course of the ureter in the pelvis but is due to the fact that the uterus is the extreme right side of the pelvis, adherent, in retroposition and descensus. From a study of the course of the ureter in cadavers and the above specimen, together with a comparison of the findings in the literature, it becomes evident that the ureters in their course through the pelvis, follow in general the curve of the pelvic walls, and as they approach the bladder they converge so that the distance between them may be but 4-6 cm. at their entrance into the bladder and 1.5-3.5 cm. at the ureteral orifices, the distances varying in individual cases and the degree of distension of the bladder.

The relation between the cervix and the ureters depends upon the size of the cervix, and the position of the uterus in the pelvis, whether in the right or left side, and, moreover, whether in retroposition or in anteposition. In the retroposition of the uterus, the ureters may be situated anterior to the uterus for their entire course, while, as known, in the anteposition of the uterus the course of the ureters is posterior to that organ until they reach the parametrium, when they cross the cervix from behind in order to reach the bladder in front.

The independent relations between the ureters and the uterus under normal conditions again manifests itself in the fact that in such conditions the cervix may be drawn almost down to the vulvar orifice and yet unless the bladder is drawn down with it there is very little displacement of the ureters, as may be shown by catheterizing the ureters and then placing a finger in the vagina, thus feeling the catheterized ureter, and dragging the cervix down with a tenaculum.

All those operating in the pelvis should bear in mind that lateral displacements of the uterus indicate that the ureter is nearer on that side and that this relation may be otherwise distorted by pathological conditions and various steps in operations. It becomes evident that definite rules cannot be laid down, but that the one requisite for an intelligent handling of the subject is the ability to recognize the parts as one comes to them. Nevertheless, there are certain other anatomical features which should be known and always borne in mind in all operations involving the pelvic portions of the ureters. In 1892 Waldeyer[14] showed that there was pictured in Krause's Anatomy longitudinal muscular bundles which extend from the bladder upwards on the ureter, but the cut was not accompanied by any description. See Figs. IX and X. Waldeyer describes them as longitudinal muscular bundles, which are united to each other by connective tissue and separated from the ureter by a space which can be injected. This sheath has a thickness of .5 to .75 mm., and, he says, extends 3.4 cm. up on the ureter. The lumen he considers to be a lymph space.

Disse[15] refers to Waldeyer's sheath and states that these muscular bundles which are greatly hypertrophied, do not arise from the bladder as they appear to do, but from the ureter, and suggests that their hypertrophied condition, as well as the space between them and the ureter, arises from the contractions of the bladder pulling on the outer ureteral coat. See Fig. X.

There are present about the pelvic portion of the ureter possibly two sheaths instead of one, the so-called sheath of Waldeyer which Disse claims arises from a hypertrophy and splitting of the outer ureteral muscular coat, and the second, which apparently encircles the upper portion of the former sheath, blending with it, and extends along the ureter. See Figs. VIII, IX, and X. Further studies may show that this second sheath is but a continuation of the other, but from the few cases I have studied it would seem to be different in origin and while blending with the other, to enclose the upper end of it, as shown in Fig. V. The anatomical relation between the two sheaths needs further investigation. The fibrous sheath apparently arises from the tissues about the pelvic portion of the ureter and is continuous with the subperitoneal tissue surrounding the abdominal portion of the ureter. This sheath, which may be called the pelvic ureteral sheath, is composed of fibrous tissue, with an occasional muscle bundle. Its lumen is for the most part filled with adipose tissue and fine fibrous tissue strands, thus acting as a cushion surrounding the ureter. One finds in the hardened specimens empty spaces which may be lymph spaces or possible artefacts. This sheath is of great importance, for it not only furnishes a channel in which the ureter may slide as it contracts, but is also a protection to the ureter from the invasion of cancerous growths (Figs. XIII, XIV, and XVII) or inflammatory processes and during operations in that portion of the pelvis. Of special interest in connection with this work is the fact that the periureteral arterial plexus, by which the ureter is nourished, lies within this sheath and is thus protected by it. See Fig. VII.

If serial sections of the parametrium are studied one can see how adherent this ureteral sheath may to the other structures in that part of the pelvis, especially the uretero-vaginal and vesico-vaginal plexuses of veins (Fig. XIII), for it is from these structures that it is apparently partially derived. It is evident that the isolation of this sheath in the parametrial portion of the ureter is very difficult on account of its association with the structures above referred to, much more so than in that portion of the ureter above the parametrium, for here it lies just beneath the peritoneum being adherent to it and by freezing the peritoneum the ureter with its sheath may be moved about on the peritoneal flap. Fig. VII.

Relation Between the Ureter and Carcinoma Cervicis Uteri as Shown by a Study of Those Cases in Which the Lower Ends of the Ureters have been Resected.

I have had the opportunity to study the parametrium from six cases in which one or both ureters had been resected.

The ideal way to study such cases would be to block the entire cervix and cut serial sections of the whole block, which aside from technical difficulties would represent in many instances for one case alone the study of 1,000 sections, each one of which would require a cover slip 6-8 cm. by 4-5 cm. to cover. Such an estimate is based on cutting the sections 40 microns thick and studying only the lower 4 cm. of the cervix. If in order to facilitate matters the uterus were split and each parametrium were cut separately, then there would be 2,000 sections instead of 1,000 as in the previous instance. Kundrat in studying 80 cases, or 160 parametria, studied but 21,000 sections. Had he employed the method above referred to it would have been necessary to study 160,000 sections, or nearly 8 times as many as he did. In the first two cases I made a sagittal section of the lower 4 cm. of the cervix and then cut each parametrium in blocks 1 cm. thick. These blocks were embedded in celloidin and each block was cut in series. The sections were stained in hematoxylin and eosin and mounted in water and then examined, and only a few of those which showed interesting points were saved and mounted in balsam.

The disadvantages of this method were that it took too much time, and again, it was inaccurate because it was necessary to trim each block before cutting it, and also the lower millimeter or more of each block was lost. I learned from these two cases, for I cut the sections myself, that it was possible to determine the presence of tissue simulating carcinoma in the parametrium, for as the sections are cut one can easily see such tissue as nerves, ganglia, lymphoid tissue, etc., in the parametrial tissue, for they appear as opaque white tissue having the form of these structures and can be clearly differentiated from the other structures in the parametrium, as adipose, fibrous tissue, and the blood vessels. In the next two cases an attempt was made to be more thorough, so the lower 4 cm. of the entire cervix was embedded in celloidin and an attempt was made to cut it in series, but here the difficulties of properly embedding such a large piece of tissue presented themselves, and in cutting the tissue phleboliths were encountered in the veins which dulled the knife and made it necessary to dig them out, and before finishing more tissue had been lost than by the previous method

The following method, which is but a modification of the first one, has proven fairly satisfactory, although it is far from being ideal and can be criticised from the standpoint of exactness and thoroughness. It has been employed in 6 cases, in 2 of which the ureters had been resected and not in the other 4.

The entire specimen, without cutting it open, is hardened in formalin, 4%, for 48 hours, then washed in running water for a few hours, then placed in 80% alcohol. The cervix is amputated above the parametrium and then bisected antero-posteriorly, thus forming two pieces of tissue consisting of one-half of the cervix and the parametrium on that side. An incision about 3 mm. deep is now made in the posterior surface of each half of the cervix, parallel to the edge of bisection, and if on the left half this incision is placed nearer the mid line than on the right; then by comparing the two sides the left can always be distinguished from the right side. The object of this incision is to enable one always to be able to determine the anterior from the posterior border of the section after it is mounted, and also to distinguish the left from the right side should the labels come off. Cross sections 1 cm. apart are now made of each piece of tissue. This gives 4 or 5 blocks 1 cm. thick for each side, or 8 or 10 blocks for each specimen. These blocks are numbered, I, II, III, IV, and V, for each side, depending on the number of blocks beginning from above down. See Fig. VI. The blocks are embedded in celloidin and cut 40 microns thick, each fifth section being saved and placed on a piece of paper which contains the number of the block and the section, as for example, the section from which Fig. VIII was drawn has the number R. III, 6, which means that it is the thirtieth section cut from the third block of the right half of the uterus, counting from above downwards, and so can be located in the drawing of the gross specimen. See Fig. VI. Thus every fifth section cut is saved, and in addition all sections showing any tissue resembling cancer, as nerves, ganglia, lymph nodes, etc., which, as stated, can be seen with the naked eye as the sections are out. On this account I have cut the sections in every instance. These sections are stained in hematoxylin and eosin, mounted, and such as are found to be interesting are saved. The expense of glass to mount them on is quite an item, and I found that old photographic negatives can be bought very cheaply and can be cut into suitable sizes, as, for instance, a 4 x 5 negative cut in two makes two very good slides, on each of which one or sometimes two sections can be mounted, using mica for cover slips.

The lymphatics of the pelvis have been handled as follows: The tissue with the lymph nodes is embedded in celloidin the entire block thus formed is cut; all sections are saved and placed in a bottle; a few sections from the bottle are stained, and if cancer is found the rest are not stained, otherwise, the stains are poured into the bottle and thus the entire contents of the bottle are stained at once, and after being stained they are kept in alcohol and sections are removed from the bottle and mounted in balsam and studied either until cancer is found or until they have all been mounted and studied, thus excluding cancer.

From a study of the parametrium in these few cases alone, much may be learned about the anatomical relation between cancer of the uterus and the ureters. One must consider the following classes of cases:

1. Cases in which the growth is restricted to the cervix and the cervix has not been enlarged by the growth.
2. Cases in which the growth is restricted to the cervix but the cervix has been distended by the growth, thus bringing the cervix nearer the ureters.
3. Cases in which there has been a direct extension of the growth out into the parametrium.
4. Cases in which there has been a metastasis of the growth to the structures of the parametrium, as the lymph nodes, lymph channels, sheaths of the nerves, ganglia, blood vessels, etc.

1. Parametria where the Growth is Restricted to the Cervix and the Cervix has not been Enlarged by the Growth.

In such cases the relation between the cervix and the ureters would be the same as under other conditions where the uterus is not involved by carcinoma. This relation has been previously discussed.

2. Parametria where the Cancer is Restricted to the Cervix, but on Account of its Size has Greatly Enlarged the Cervix.

If one will study cross sections of the pelves of women who have died during the puerperium, a very clear idea may be obtained of the relation between the ureter and the cervix when the latter is enlarged, thus bringing the two structures in closer relationship. This is well shown in the illustration of such cases in Webster's[16] work on female pelvic anatomy. In Fig. VIII and IX the cervix is only slightly enlarged by the carcinoma, but measurements from the sections from which these illustrations were made show that the distance between the cervix and the ureter at these levels is less than 4 mm. and yet the parametrium is not invaded by the growth and the cervix is not greatly enlarged. On the other hand, the specimen from which Fig. XI was made shows a cervix which is enlarged by the growth nearly half again as great as the case from which the other two illustrations were drawn, yet in the section from which the latter drawing was made the distance between the ureter and the cervix is twice as great as in the other two cases, which may be explained because it is from a section higher up in the parametrium than the other two and possibly the ureter was further away from the cervix in this case than in the other. In the upper portion of the parametrium the ureter is some distance from the cervix, possibly 2 or 3 cm., but draws near the cervix as it approaches the bladder, and in addition one ureter may be much nearer the cervix than the other depending on the position of the uterus in the pelvis. As one would infer, the larger the cervix the nearer the distance between the two, as shown by cross sections of the female pelvis taken during the puerperium, where the cervix is enlarged.

3. Parametria with a Direct Extension of the Cancer out from the Primary Growth.

From a study of the anatomical relations between the cervix and the ureter one must realize that while it would take considerable extension of the growth to reach the ureter in the upper portion of the parametrium, for they may be separated from each other for a distance of 2 to 3 cm., that on the other hand, it requires but a slight amount of parametrial involvement to extend to or beyond the ureters in the lower portion of the parametrium, for this distance may be less than 5 mm., as shown in Figs. V, VIII and IX. The above point is clearly shown in Figs. XIII and XIV, both from the same case. In Fig. XIII, which is from the upper portion of the parametrium, the ureter is over 1 cm. distant from the cervix, which is enlarged by the extensive cancerous process. On the other hand, in Fig. XIV, which represents a section taken from the lower portion of the parametrium, one can see the true nature of the growth, how it is invading the bladder muscle and has extended out to and invaded the pelvic ureteral sheath. Notice how the sheath has become hypertrophied, thus better protecting the ureter, and that it apparently is derived from the pelvic structures and at this point is intimately connected with the utero-vaginal plexus of veins and that it would be very difficult to separate it from the latter. The involvement of the ureteral sheath by carcinoma is more clearly brought out in Fig. XV which is from another case. Here one sees the marked hypertrophy of this sheath and how it protects the ureter and its arterial plexus.

4. Metastases of Carcinoma Cervicis Uteri into the Parametrium.

The relation between cancer and the regional lymphatics is one of the most interesting and important phases in the treatment of cancer of the uterus.

Apparently three types of lymph nodes must be recognized in the parametrium:

A. The large (relatively) lymph nodes sometimes found in the parametrium near the ureter.

B. The minute parametrial lymph nodes.

C. The lymph nodes situated within the lymph channels.

A. The Large Parametrial Lymph Nodes.

Poirier,[17] in his recent work on the lymphatics, discusses the presence of these lymph nodes and states that one may find as an abnormality a fair sized lymph node where the lymphatics coming from the cervix cross the ureter. This undoubtedly is the lymph node which is represented in Fig. XI, as situated posterior and lateral to the right ureter. In this instance it had a diameter of .8 cm. and was recognized at the time of the operation. The entire node was cut into sections and all the sections were examined. There was no evidence of carcinoma found in the node, and its histological structure was similar to that of nodes in other portions of the body. I believe that a similar node is represented in Fig. XVII, which is from another case. Its situation is similar to the above. This latter node was cancerous and had become necrotic and cystic. Its diameter was over 1 cm. in the fresh condition.

Not only should the possibility of the existence of this node be borne in mind, but also its relation to the ureter, for in these two cases it was found posterior and lateral to it and would have been overlooked in a hysterectomy mesial to the ureter.

B. The Minute Parametrial Lymph Nodes.

One may find scattered throughout the entire parametrium minute lymph nodes whose structure apparently differs in no way from that of the larger nodes throughout the body. These nodes are represented in Figs. VIII and X and in neither case were they involved by cancer. The one represented in Fig. VIII was oval in form and had a long diameter of less than 2 mm. I found one of these nodes involved by cancer in two cases where the ureters had not been resected and in one case apparently the situation of the node had been lateral to the ureter. In neither of these two cases did the cancerous process increase the size of the node. I have found the number of these parametrial nodes variable, but never greater than 5 in any one parametrium. Poirier,[18] in referring to the lymphatics in any region, states that according to Stöhr the lymph vessels pass through three distinct glandular stages during their course. First of all, there are the small nodules of interrupted glands, Schaltdrüsen, whose presence is inconstant, and number variable, and which are always unaffected by injections; then, come the regional glands, where the glands are larger and more constant. Finally, there are the intermediary glands. Poirier criticises this classification showing that one cannot always divide these glands into three distinct groups. He states that the knowledge of these relays of glands placed in succession one behind the other in the lymph stream, is interesting from a pathological point of view, for they constitute so many stages at which the spread of infections and cancer is temporarily arrested. I do not know whether these nodes which I have described may be called interrupted nodes or not, but one fact is certain, and that is that they have the histological appearance of the large lymph nodes and cancer may metastasize to them and that without enlarging these nodes so that they may be so small that they cannot be palpated in the parametrium even after the specimen has been removed.

C. Lymph Nodes in the Lymph Channels, or Intravascular Lymph Nodes.

In the parametrium of a case of carcinoma of the cervix which I[12] reported over a year ago, there were found small lymph nodes varying in size from 1 to 2.5 mm., in diameter. These nodes were apparently situated in the lymph channels, partially filling the lumen like a sponge and were in places attached to the wall of the lymph vessels, and in some instances could be seen forcing their way through the wall of the lymph channels from the outside. There were many of these nodes in the parametrium of this case, eight being present in one section alone. In this section one could follow the course of the lymphatics through the parametrium by means of these nodes of lymphoid tissue. Histologically they resembled somewhat the ordinary lymph nodes except they gave the impression of having been made in a hurry, for in some apparently the germinal centers were absent and in those in which they were present they were poorly defined. About the periphery of these nodes could be seen spaces through which the lymph could pass. Cancer was found in only two of these nodes and the presence of the growth did not apparently increase the size of the node. All the other nodees were free from cancr. Fig. XVI represents a section in which there are 4 of these nodes in the parametrium, and the one which is posterior and lateral to the double ureter contains cancer. The distance between the double ureter and the cervix in this section is over 1 cm. I have found these nodes in other cases. One can imagine many things in regard to their function, as, that they are newly formed and act as a means of protection to the individual from the extension of the growth. It is of interest to know whether they can give rise not only to the other minute typical lymph nodes found in the parametrium, but also to the larger lymph nodes. Kundrat speaks of them as intravascular lymph nodes. He divides them into two classes, first, those which project into the lumen of the vessel, being attached to it by a pedicle; secondly, those which apparently have invaded the wall of the lymph channel, a portion of the lymphoid tissue being within the lumen and a portion outside. He thinks that possibly the latter group is a forerunner of the first. The schematic representation of these lymph nodes is well shown by Kundrat. Perhaps these nodes are the interrupting nodes previously referred to in this article which are not affected by injections. The subject with its bearing on the lymphatics throughout the entire body, needs further investigation.

D. The Metastasis May Occur in the Lymph Channels, etc.

It is quite remarkable how rarely one finds metastasis in the lymph channels. In Fig. XV there is present carcinoma apparently in a lymph space just outside of the cervix. This may be a metastasis but is more likely to be a direct extension of the growth. Unfortunately some of the sections in the series were lost at this point and I was unable to determine whether it was a metastasis or had arisen from a direct extension of the growth. In the few cases in which I had studied the parametrium, only 10 in number, the spreading of the growth from the cervix has been either by direct extension or by metastases to the lymph nodes of the parametrium or pelvis, and in only one instance have I seen what was apparently a metastasis in the lymph channel and have never seen metastases in the nerve sheaths or in the ganglia, as represented by Kundrat and as has been described by other writers.

How the Relation Between Carcinoma Cervicis Uteri and the Ureters Influences the more Radical Operation.

The high percentage of recurrences shows that hysterectomy alone cures cancer of the cervix in only a small portion of the cases. This is explained by a study of the parametrium in the operable cases, in which Kundrat has shown that there has been an extension of the growth into that tissue in over 50 per cent of the cases. A study of the anatomical relations between the ureter and the cervix shows that the distance between the ureter and the cervix becomes less as one approaches the bladder and that the lower portion of the ureter may lie within 5 mm. of the cervix, and may unfortunately pass through the tissue first invaded by the cancer. See Figs. VIII, IX, XIII, and XIV. It takes but a very little invasion of this tissue for the growth to reach or extend beyond the ureter. See Figs. XIII and XIV.

Clinical observations confirm the close relation between cancer of the cervix and the ureters, as renal insufficiency may result from a compression of the ureters in the extension of the growth, and the fact that injury to the ureters occurs so frequently in operations for cancer of the cervix.

The result of the above is that the operation which would give the highest percentage of cures is one in which the entire parametrium is removed, including the lower 3 cm. of the ureters, and the renal ends of the ureters are implanted into the bladder. The criticism against this procedure is the danger of ascending renal infection and the liability of ureteral stricture, because the ureter is implanted under tension. I have studied the etiological factors in the causation of ascending renal infection and these results have been published.[19] In this article the importance of lowered renal resistence was emphasized and that probably a stricture of the ureter was the most frequent cause of such lowered local resistence. The frequency of cystitis following this operation was also referred to and attention called to the fact that probably the cystitis could be controlled and the danger of ascending renal infection obviated by making a vesico-vaginal fistula at the close of the operation. The tension of the implantation could in a great measure be relieved by bringing down the peritoneal flap on which the ureter lies with its sheath, see Fig. VII, and after implanting the ureter into the bladder the sheath with the peritoneum may be sutured to the bladder, which may be freed if necessary in order to lessen the tension. By this procedure the tension of the implantation is not only relieved but the ureteral sheath is preserved, thus protecting the ureter and its arterial plexus and furnishing a channel in which the ureter may contract.

The dissecting free of the ureters from the parametrium is attended with danger of ureteral necrosis and ureteral stricture. I[20] have studied the efficiency of the blood supply of the ureter and showed that, based on anatomical, experimental, and clinical studies, the maintenance of the periureteral arterial plexus is necessary for the prevention of ureteral necrosis. The ureter is nourished by a periureteral arterial plexus which, if intact, can probably be maintained by any one ureteral artery. When the ureter is dissected free in these more radical operations, the ureteral arteries supplying the lower portion of the plexus are destroyed, which means that this portion of the ureter must be nourished by the blood coming through the plexus from above. If the ureter is handled roughly there is the danger of injuring this plexus so that necrosis will occur. In addition when the ureter is dissected free from its sheath, as it is in these operations, it becomes imbedded in scar tissue, its function is interfered with, and there is the danger of ureteral stricture and ascending renal infection, for of two patients dying of ascending renal infection the ureters were resected in one and not in the other.

Whichever course is followed in these operations, as the result of anatomical studies, confirmed by animal experimentation and clinical experience, *the periureteral arterial plexus and also the ureteral sheath should be preserved.*

The hysterectomy mesial to the ureters preserves the ureteral sheath and thus the ureter with its periureteral arterial plexus, but does not remove the tissue about and lateral to the ureter which unfortunately must be involved in many instances, for the lower ends of the ureters lie frequently within 5 mm. of the cervix in the region first invaded by the carcinoma and so it would take but a very slight involvement of this tissue by metastasis or direct extension of the growth to reach or extend beyond the ureter, VIII, IX, XIII, and XIV, and again, one is not able clinically to diagnose the presence of cancer in the parametrium, see Fig. XVI.

Description of Operation, Based on Anatomical and Pathological Studies and Clinical Experience.

1. Building up of the patient before the operation, rest in bed, and treatment of anæmia if present are very essential. I do not see that there is anything to be gained by the preliminary curettage of the growth, except in occasional cases when it is necessary to do it in order to control the bleeding, or there is present a very foul mass. The danger of infection during the operation is minimized by the use of the Wertheim clamps in the operation. A thorough cleaning out of the intestines before the operation is very important.

2. The preliminary catheterization of the ureters certainly aids during the operation and can usually be done with the patient in the Sims posture[21] before taking the anesthetic.

3. After the patient is anesthetized the passing of a rectal tube will frequently relieve any distention of the large intestines, if gas is present, for one wishes as much room as possible during the operation.

4. The preliminary vaginal sutures previously described[2] need not be placed all the way around the vagina, but 2 or 3 on each side will occlude the main vaginal veins which help form the utero-vaginal plexus situated lateral to the ureters, see Figs. II, III, IV, XIII, and XIV. These sutures of catgut are passed with a large needle, include large masses of tissue, and should be placed about 3 cm. below the growth. These sutures are of a greater service when the ureters are dissected free than when they are resected, as in the former procedure the ureter with its sheath must be freed and the latter is partly formed by this plexus, see Fig. XIII, the main trunks of which are supplied by veins included in the preliminary sutures.

6. The patient is now placed in the high Trendelenberg position and an incision is made from the umbilicus to the symphysis down to the peritoneum, but not through it. The peritoneum is now pushed back from the anterior abdominal wall and a transverse incision is made through it just above the bladder. This gives rise to a peritoneal apron, which, after pushing back the intestines, is sutured to the posterior pelvic wall with catgut, thus shutting off the general peritoneal from the pelvic cavity and keeping the intestines from the field of operation, and doing away with bolsters and gauze pads in the general peritoneal cavity. This exposure which was first described by Poten,[22] is all that could be desired, especially if a self-retaining retractor is used and the sides of the abdominal incision are protected with gauze. It seems to me that the incisions proposed by Amann[23] and Machenrodt[24] (which I[2] referred to over a year ago) where the recti are cut, are unnecessary. I have used the Poten incision in 8 of 11 of these more radical operations and think it is much to be preferred to the older methods of packing back the intestines with gauze. It protects the abdominal cavity better and also possibly diminishes the shock of the operation, although I have seen patients at the close of an operation where this was used apparently as much shocked as in other cases where it has not been used. This peritoneal flap is released at the close of the operation and the incision in the peritoneum is closed transversely.

7. After obtaining a satisfactory exposure the high Trendelenberg position may be lowered if so desired. The ovary on the left side is now grasped by a pair of forceps and pulled outwards and towards the symphysis, thus making taut the ovarian vessels and the peritoneum covering the iliac vessels. The peritoneum is split below and parallel to the ovarian vessels as high up as the iliac vessels. The ureter will lie on the lower peritoneal flap and be out of harm's way. The ovarian vessels and the round ligament are now cut. Beginning at the origin of the internal iliac artery, dissect downwards, removing the fat and lymphatic structures, including lymph nodes from along the iliac vessels, thus exposing the pelvic vessels and removing the tissue en mass. By using a blunt dissector and always dissecting down along the vessels, hemorrhage may be avoided. The uterine artery is exposed and ligated at its origin. I do not think that there is any operative advantage to be gained in ligating either the internal iliac artery or its anterior branch over the ligation of the uterine artery alone, and there is this disadvantage that the nutrition of the pelvis is interfered with, thus predisposing

it to infection and possibly necrosis. The other side is treated in a similar manner. If difficulty is experienced in locating the uterine artery, first find the obliterated hypogastric and follow that back, taking care not to injure its superior vesical branch, and this will lead one to the uterine vessel.

8. The tissue on either side is dissected from the sides of the pelvis, thus freeing the uterus and bladder with all the tissue from pelvic wall to pelvic wall, including the lower portion of the ureters, in one mass.

9. Both uretero-sacral ligaments are now ligated and cut, taking care not to injure the ureters at this point. This allows the uterus to be lifted further out of the pelvis.

10. The uterus is pulled upwards towards the umbilicus and the bladder is dissected free from the cervix down to the entrance of the ureters into that organ.

11. The treatment of the ureters should demand one's attention next. There is now situated in the pelvis a mass of tissue consisting of the uterus and all the tissue from pelvic wall to pelvic wall, through which the ureters pass. This tissue is held in the pelvis by the vagina; the ureters, which pass through it; the vesico-vaginal and utero-vaginal plexuses of veins; by the tissue uniting the vagina to the rectum posteriorly; and by similar tissue extending from the lower portion of the parametrium to the bottom of the pelvis. Whatever is done, the periureteral arterial plexus must be guarded, otherwise, there is liability of ureteral necrosis, and also if possible the ureteral sheath should be preserved, as it protects the ureter and its blood vessels, as has been explained.

a. If one decides to resect the ureters, they are cut off just within the parametrium and also at their entrance into the bladder.

b. If one decides to save them they must be dissected out from this tissue, taking care to preserve not only the periureteral arterial plexus, but also the ureteral sheath. This latter will be found to be very difficult on account of the intimate association between this sheath and the structures (see Figs. XIII, XIV, XVI, and XVII) which one wishes to remove; on the other hand, it is quite a simple matter to split the sheath open and shell the ureter out. This latter procedure is attended with danger of injuring the periureteral arterial plexus, and so possibly causing ureteral necrosis, and in addition the ureter will be deprived of its sheath and be embedded in scar tissue.

After disposing of the ureter a sponge on the end of a sponge-stick may be pushed into the vagina and by palpation one can tell how far down to dissect the vagina free. Instead of the sponge I have found very serviceable, the end of a spool which has been covered with gauze and grasped by a heavy pair of Jacob's forceps. The rim of the spool can be palpated more rapidly than the gauze sponge. The separation of the rectum from the vagina must be done with care, and also the freeing of the parametrium from the bottom of the pelvis.

12. After dissecting the vagina free down to the preliminary catgut sutures or to a point determined by palpating the spool in the vagina, the vagina is wiped dry and clamped with two right-angle clamps (Wertheim) and burned across between the two clamps with a pacquelin cautery.

13. Uretero-vesical implantation. The ureter on the lower peritoneal flap should be drawn down to the bladder. Introduce a long pair of forceps into the bladder through the urethra and push out the bladder wall in a portion of the bladder as low as possible and reaching the ureter with as little tension on the ureter as possible. An incision may be made on these forceps and a small piece cut out of the bladder wall, leaving a hole the size of the ureter; or an I incision may be made into the bladder and the 2 flaps cut out, thus leaving an opening into the bladder the size of the ureter. The end of the ureter is now slit for a distance of 3 to 5 mm. and one of the lips thus formed is grasped by the forceps and the ureter is drawn into the bladder and held there while the bladder wall is sutured to the ureter with sutures of fine silk, these sutures piercing only the bladder and ureteral muscular coats and not the mucosa. If possible have the ureter pass through the bladder wall in an oblique direction, which may sometimes be done by lengthening the incision or opening in the bladder and suturing the ureter to the sides of this opening. Care should be taken that the ureter will not be kinked when the ureter and bladder are in the position they will assume at the close of the operation, and that the ureter is not compressed by the sutures, causing a stricture. The portion of the ureter which enters the bladder is free from its sheath. The sheath and peritoneal flap are now sutured to the bladder wall. If possible fix the site of the implantation by suturing the bladder at this place to the side of the pelvis. By bringing the ureter down on the peritoneal flap and suturing the sheath and the peritoneum to the bladder, the ureter is provided with a sheath, and the sheath and the peritoneum should relieve to a great extent the tension of the implantation. In addition, the bladder may be dissected free in order to help relieve the tension of the implantation. I have made eleven uretero-vesical implantations in women and twenty-five in dogs, and have tried the method previously reported by me[2] and also the Budinger[25]-Witzel[26] implantation, but think that while both the latter have their advantages the one described above will be the most successful in the greatest number of cases. On account of the great liability to cystitis in these cases, the formation of a vesico-vaginal fistula at the close of the operation, or within the first week after the operation, is a most suggestive procedure, in order to control the bladder infection and thus minimize the danger of ascending renal infection.

14. All raw areas are covered with peritoneum and two small drains are placed in each side of the pelvis and out through the vagina.

I have done eleven of these more radical operations, resecting one or both ureters in three cases. Three cases have died, one on the fifth day from intestinal obstruction, and two from ascending renal infection, one dying on the ninth day and the other upon the seventeenth. In the two cases dying from renal infection the ureters were resected in one and not in the other. Ureteral necrosis occurred in one of the cases in which the ureters had been dissected free. As yet I have not intentionally made a vesico-vaginal fistula in any case, but in eleven cases in which I have studied the bladder after the operation by taking cultures and making cystoscopic examinations, cystitis was present in 8, while in 3 cases where it was apparently absent an accidental vesico-vaginal fistula was present.

CONCLUSIONS.

I. The relation between carcinoma cervicis uteri and the ureters manifests itself clinically:

First, in renal insufficiency resulting from a compression of the ureters by the growth.

Secondly, in the frequency of accidental injury to the ureters occurring during operation for the removal of the growth, there having been in this hospital 19 cases of accidental injury to the ureter in 156 hysterectomies for carcinoma of the cervix as compared with only 11 similar injuries in 4513 other major gynecological operations.

II. A study of the anatomical relations between the ureters and the other pelvic strictures shows:

a. The ureters follow the curve of the pelvic walls and the ureteral orifices are 1.5 to 3.5 cm. apart, the distance varying in individual cases and in the condition of the bladder whether distended or contracted.

b. Under normal condition, the relation between the cervix and the ureters depends upon the position of the uterus whether in the left or right side of the pelvis and also upon the size of the cervix. At the entrance of the ureters into the parametrium, they are at a distance equal to the inside transverse diameter of the pelvis apart at that level and so may be some distance from the cervix, even as great as 3-3.5 cm. On the other hand near the bladder the distance between them is much less, and this distance on one side may be less than 5 mm., in the left and right displacements of the uterus. Unfortunately the lower portion of the parametrium is apt to be the part first invaded by a direct extension of the growth.

c. In retroposition of the uterus, the entire pelvic course of the ureters may be situated anterior to the uterus. This relation may also be greatly distorted by other pathological conditions and by steps in gynecological operations.

III. The pelvic portion of the ureter lies in a sheath which protects the ureter and its periureteral arterial plexus and furnishes a channel in which the ureter may slide as it contracts. This sheath is composed of fibrous tissue, in places reinforced by small muscle bundles, and is apparently derived from the tissue through which or along which the ureter passes and on this account it is very intimately connected with the structures found in the parametrium and its separation from the parametrium is difficult. The lower portion of the ureter is reinforced by muscular bundles also giving rise to a sheath, which Disse claims originates from the ureter and not from the bladder as they apparently do. The fibrous sheath referred to above, while fusing with the muscular sheath, encircles the upper end of it and apparently is a separate and distinct sheath. The anatomical relation between these sheaths needs further study. Recognition of the ureteral sheath is important in all operations involving the lower portion of the ureter, but especially so in the more radical operations for carcinoma cervicis uteri, for in the extension of the growth this sheath becomes involved and hypertrophied, thus protecting the ureter and later as the growth extends compressing it and causing renal insufficiency.

IV. Pathologically, the close relation between carcinoma cervicis uteri and the ureters shows itself:

1. In the distension of the cervix by the growth, thus diminishing the distance between the ureters and the cervix.

2. In the direct extension of the growth from the cervix into the parametrium. As the distance between the ureter and the cervix may be less than 5 mm. in the lower portion of the parametrium, which, unfortunately, is the part of the parametrium first involved by a direct extension of the growth, it takes but very little involvement of the parametrium to reach or extend beyond the ureters.

3. In the metastases to the parametrium, which may occur:

a. In the large parametrial lymph node, occasionally found at the place where the uterine artery crosses the ureter. See Figs. XI and XVII.

b. In the small parametrial lymph nodes scattered throughout the parametrium. Such nodes are represented in Figs. VIII and X (but were not involved in these sections). I have seen them involved in others cases.

c. In the intravascular lymph nodes which protrude into the lymph channels like sponges and may be present in large numbers in these cases. See Fig. XVI.

d. In the other structures of the parametrium as sheaths of nerves, ganglia, lymph spaces, blood vessels, etc.

V. From a study of the parametrium in these cases it becomes evident that the ureter passes through tissue which should be removed in every instance of cancer of the cervix, for it is impossible to diagnose clinically a cancerous parametrium, and there is no relation between the size of a primary growth and the parametrial involvement, for the parametrium may be involved in a small growth and free in a large one.

VI. Two ways of removing all the parametrial tissue present themselves:

1. The dissecting free of the ureters and after drawing them to one side, the removal of all the tissue from pelvic wall to pelvic wall.

2. Removing all the tissue from pelvic wall to pelvic wall, including the lower portion of the ureters, and implanting the renal ends of the ureters into the bladder.

VII. Based on anatomical studies, animal experimentation and clinical experience, two anatomical structures should be preserved; namely, the blood supply of the ureter and the ureteral sheath.

VIII. When one ligates the internal iliac or its anterior branch, the ureteral arteries completing the lower end of the periureteral arterial plexus are cut off and the lower ends of the ureters must be nourished by blood from the upper ureteral arteries, which are able to do this if the periureteral arterial plexus is intact. If in addition the ureter is dissected free from the ureteral sheath, which is quite easy to accomplish, as all one has to do is to split it open and shell out the ureter, there is danger of injuring the periureteral plexus and liability for ureteral necrosis. In addition, the ureter now lies as a loose cord in the pelvis, its sheath has been destroyed and it becomes embedded in scar tissue with the chance of interference with its function through the ureteral strictures arising from its being embedded in this tissue, hence predisposing the kidney to ascending renal infection. On the other hand, the dissecting free of the ureter with the sheath intact is very difficult, because the sheath arises from the pelvic structures and, in addition, in such cases as are represented in Figs. XIII and XIV, would certainly leave cancer in the pelvis. I am unable to see any operative advantages to be gained in the ligation of the internal iliac artery or its anterior branch over the ligation of the uterine artery alone, and it increases the liability of ureteral necrosis and predisposes these parts to infection.

IX. Removing all the tissue from pelvic wall to pelvic wall with the lower ends of the ureters offers the greatest chance for a cure and at the same time the ureteral sheath and periureteral arterial plexus may be preserved, for the portion of the ureter which is above the parametrium lies on the peritoneum, and this peritoneal flap may be brought down, and with the ureteral sheath sutured to the bladder. The suturing of the sheath and the peritoneum to the bladder relieves in a measure the tension of the implantation and the periureteral arterial plexus is preserved and also the ureteral sheath. Against this procedure are the uncertainties of the uretero-vesical implantation and the danger of ascending renal infection. Careful work should minimize the chance of failure in the uretero-vesical implantation, and possibly the formation of a vesico-vaginal fistula at the close of the operation may lessen the danger of the ascending renal infection. It can be seen that the operation which clinical experience and the study of the parametrium demands as the one which will give the greatest percentage of cures, is a very serious one and attended with uncertainties. Whether this operation ever will be justifiable in all cases, experience alone can decide. In those cases in which the ureteral sheath is involved by the growth it should be the operation of choice; on the other hand, when the ureteral sheath is not involved, it may be possible to dissect the ureters free with their sheath and thus preserve the lower ends of the ureters. The greatest difficulty comes in making a diagnosis, *for only by the use of the microscope can it be definitely decided whether or not cancer is present in the parametrium.*

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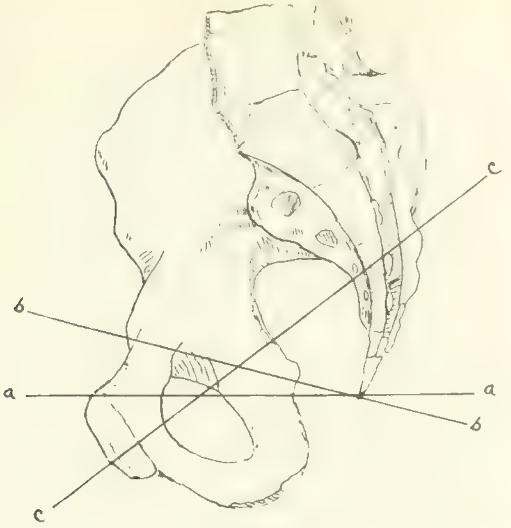


FIG. I.—VIEW OF THE INSIDE OF THE RIGHT HALF OF THE PELVIS OF A WOMAN STANDING, × 3/10 (SPALTEHOLZ).

a-a represents a horizontal plane passed through the body from the top of the symphysis.

b-b represents the general inclination at which the pelvis was cut, in the two sections represented in Figs. III and IV.

c-c represents the probable plane at which the section shown in Fig. II was cut.

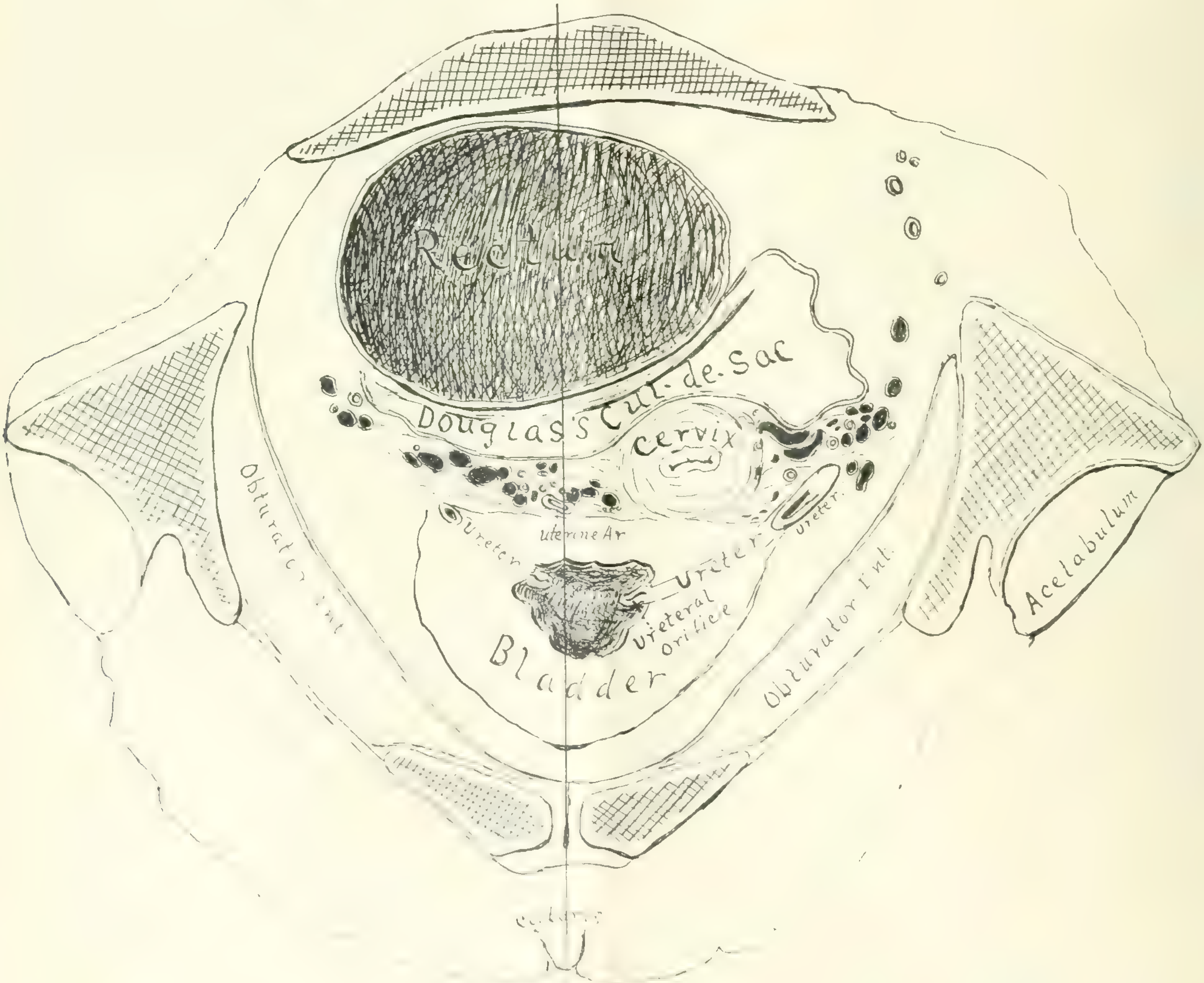

Rectum
Douglas's Cul-de-Sac
cervix
Obturator Int
Ureter
uterine Ar
ureter
Ureter
ureteral orifice
Bladder
Obturator Int.
Acetabulum

FIG. II.—CROSS SECTION OF THE PELVIS OF A VIRGIN 17 YEARS OLD, × 1 (TANDLER AND HALBAN).

Section taken at the level of the ureteral orifices in the bladder (c-c, Fig. I).

The uterus is in the left side of the pelvis and as a result the left ureter is .5 cm. from the cervix, while the right is 2.5 cm., or 5 times the distance.

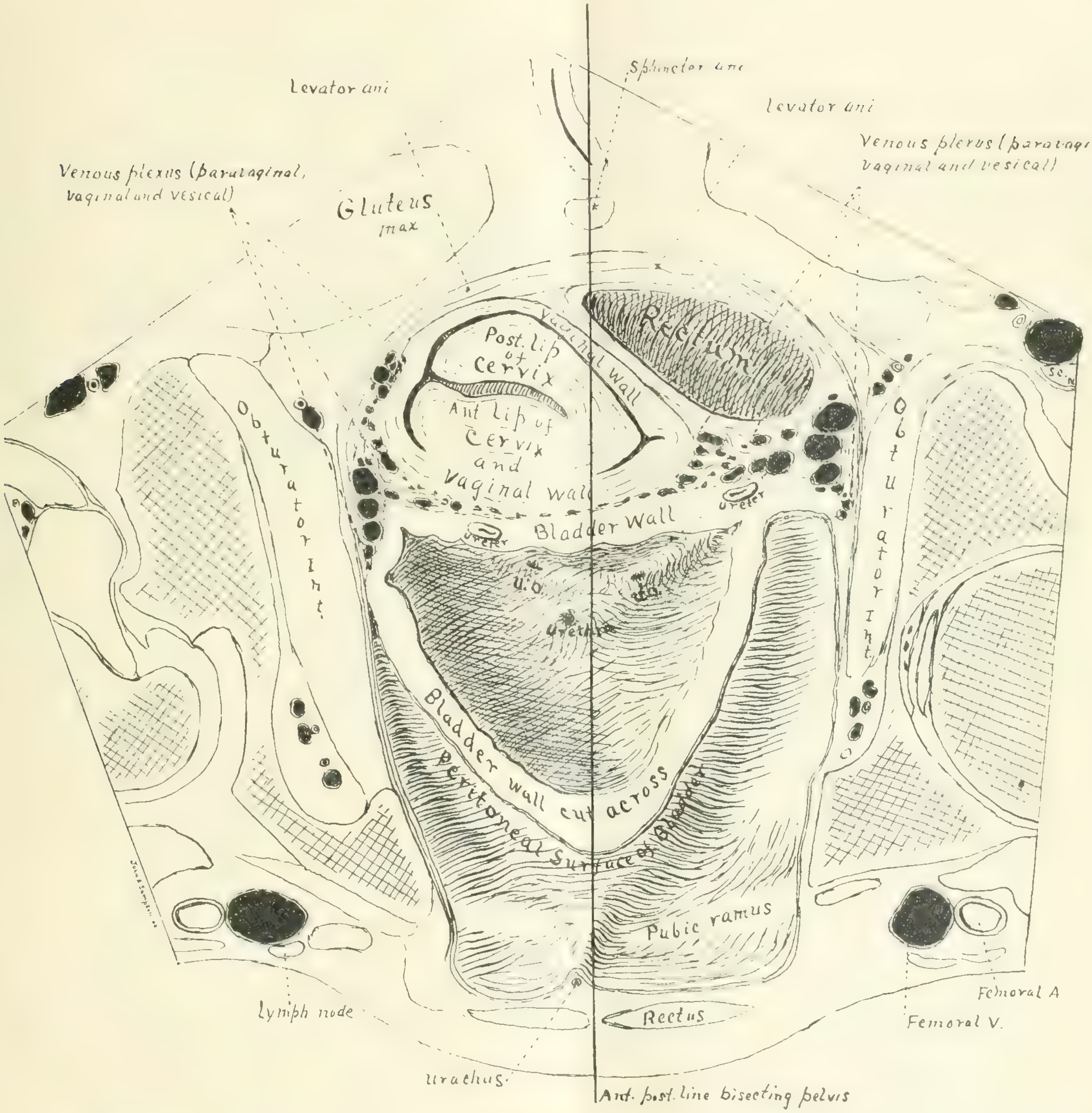

Levator ani
Sphincter ani
Levator ani
Venous plexus (paravaginal, vaginal and vesical)
Venous plexus (paravaginal, vaginal and vesical)
Gluteus max
Post. lip of Cervix
Vaginal wall
Rectum
Sc. N.
Obturator Int.
Ant lip of Cervix and Vaginal wall
Obturator Int.
ureter
Bladder Wall
ureter
U.O.
U.O.
Urethra
Bladder wall cut across
Peritoneal Surface of Bladder
Pubic ramus
Femoral A
Femoral V.
Lymph node
Rectus
Urachus
Ant. post. line bisecting pelvis

FIG. III.—CROSS SECTION OF THE PELVIS OF A MULTIPARA 30 (?) YEARS OLD, × 1. (FROM A SPECIMEN IN ANATOMICAL LABORATORY, JOHNS HOPKINS MEDICAL SCHOOL.)

Section taken above ureteral orifices in the bladder and represented by line VI in Fig. V.

The uterus is in retroposition adherent, and in the right side of the pelvis. The right ureter is but 3 mm. from the vagina, while the left is 8 mm. distant in this section. Notice the venous plexuses which give rise to the bleeding so troublesome in these operations. Compare with Fig. II and note that the relation of the uterus to the ureters is dependent on the position of the uterus in the pelvis. The section was not cut horizontal, being higher in the left than the right side (see line VI in Fig. V).

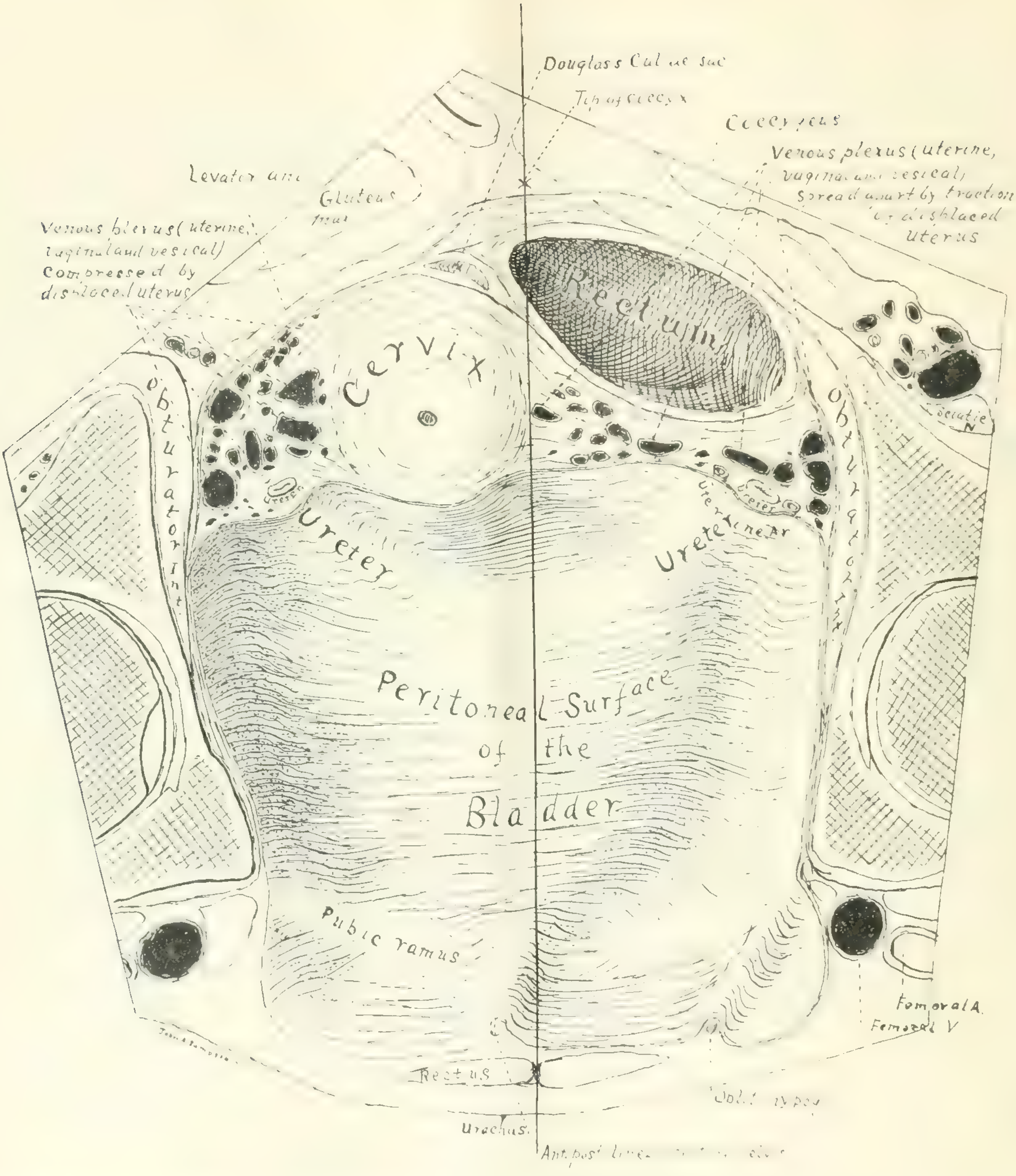

Douglass Cul de sac
Tip of Coccyx
Coccygeus
Venous plexus (uterine, vaginal and vesical) Spread apart by traction of displaced uterus
Levator ani
Gluteus max
Venous plexus (uterine, vaginal and vesical) compressed by displaced uterus
Cervix
Rectum
Sciatic N
obturator Int
obturator Int
Ureter
Ureter
Ureter
Ureter
Uterine Ar
Peritoneal Surface of the Bladder
Pubic ramus
Femoral A.
Femoral V
Rectus
Obl. hypog
Urachus.
Ant. post line

Fig. IV.—Cross Section of the Pelvis of a Multipara 30 (?) Years Old. × 1. (Section taken 1.5 cm. above the one represented in Fig. III.)

Section represented by the line b-b, Fig. I, and V, Fig. V.

Uterus is in retroposition, adherent, and in the right side of the pelvis. The right ureter is but 8 mm. from the cervix, while the left is 3.5 cm. or over 4 times this distance. The relation of the two ureters to the fixed structures of the pelvis, as the pelvic walls, is the same for both ureters, while their relation to the uterus is dependent on the position of the uterus in the pelvis.

Notice the venous plexuses which give rise to the bleeding so troublesome in these operations and to a great part controlled by the preliminary vaginal sutures described in this article. The uterus was in retroposition and posterior to the ureters for their entire pelvic course, so that the cervix was not crossed by the ureters as it is when the uterus is in the anteposition; thus accounting for the situation of the ureters anterior and not lateral to the cervix.

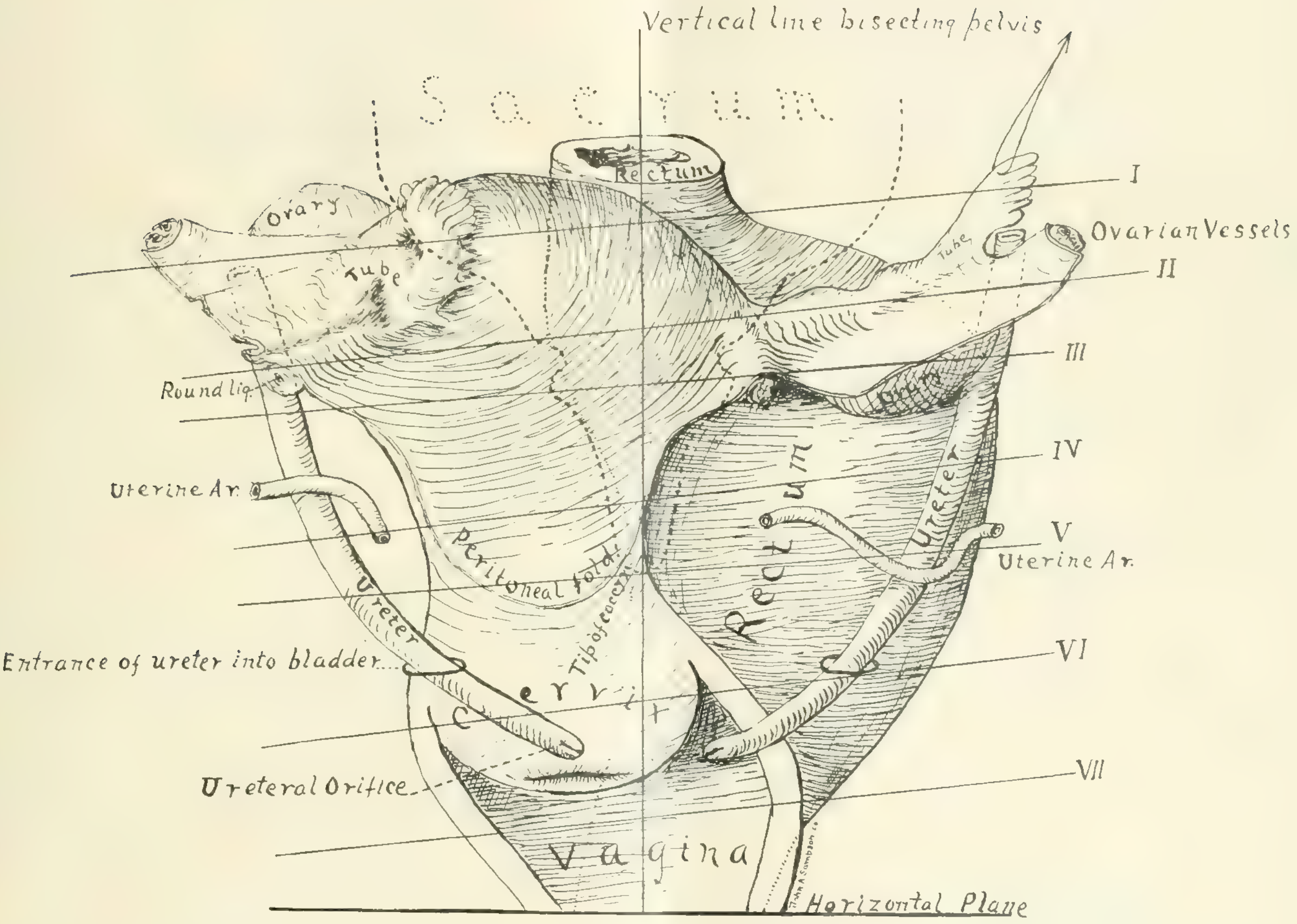

Vertical line bisecting pelvis
Sacrum
Rectum
Ovary
Tube
Tube
Ovarian Vessels
I
II
III
Round lig.
IV
Uterine Ar.
Rectum
Ureter
V
Uterine Ar.
Peritoneal fold
Tip of coccyx
Ureter
VI
Entrance of ureter into bladder
Cervix
Ureteral Orifice
VII
Vagina
Horizontal Plane

Fig. V.—Reconstruction of the Relation between the Ureters and Other Pelvic Structures, from Cross Sections of the Pelvis of a Multipara 30 (?) Years Old, × 1 (same Case from which Figs. III and IV were drawn).

The lines I to VII represent the sections from which the reconstruction was made.

The rectum is in the left side of the pelvis and the uterus in adherent retroposition in the right side. The course of the ureters is the same on the two sides, but on account of the displacement of the uterus, the right ureteral orifice is situated directly in front of the middle of the cervix, while the left is situated lateral to the cervix. The relation between the ureters and the uterus is shown and one can see that it is dependent on the position of the uterus in the pelvis.

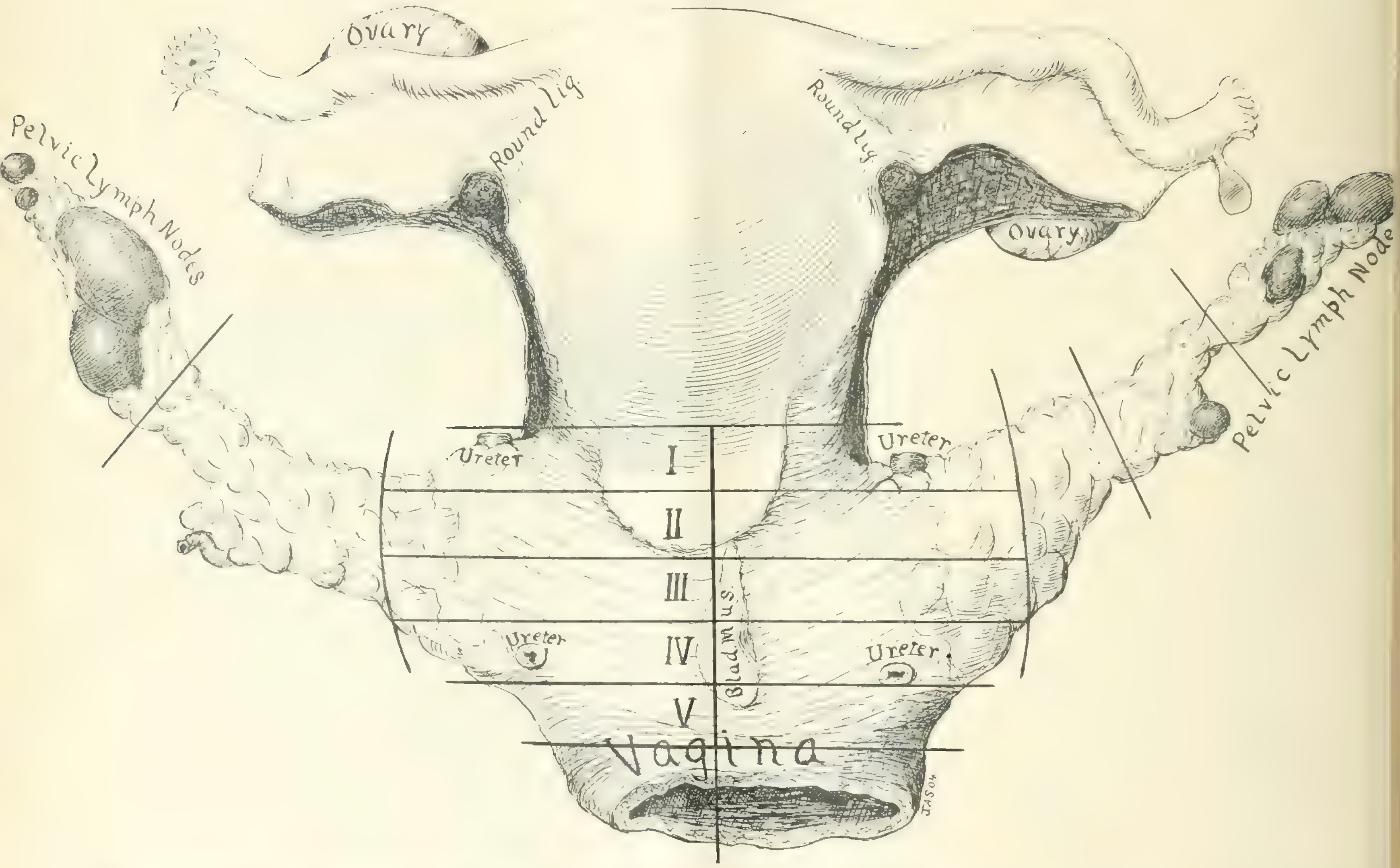

Ovary
Round lig
Pelvic Lymph Nodes
Round lig
Ovary
Pelvic Lymph Node
Ureter
Ureter
I
II
III
IV
V
Ureter
Ureter
Blad. Mus.
Vagina
J.A.S. 04

Fig. VI.—Represents what may be gained by Dissecting the Lymphatics from the Sides of the Pelvis and Removing with them all the Tissue from Pelvic Wall to Pelvic Wall, including the lower 4 cm. of the Ureter. × 1. Gyn. No. 10,505. Gyn. Path. No. 6747.

By this method there is an excision of the entire parametrium which is so frequently involved in cancer of the cervix (see Figs. XIII, XIV, XV, XVI and XVII).

In studying the specimen histologically the cervix is bisected and each half with its parametrium is divided into blocks 1 cm. thick, and each block is cut in sections 10 microns thick and every fifth section is stained and studied, as for example, the section from which Fig. VIII was made is labelled III, R. 6, which means that it is the sixth section saved, or the 30 sections cut in the block III on the right side. Only such sections are saved as have interesting features.

The lymph nodes are studied as described and the tissue between them and the primary growth is studied in the same manner as the parametrium.

Figs. VIII, IX, X and XV were drawn from sections made from this specimen.

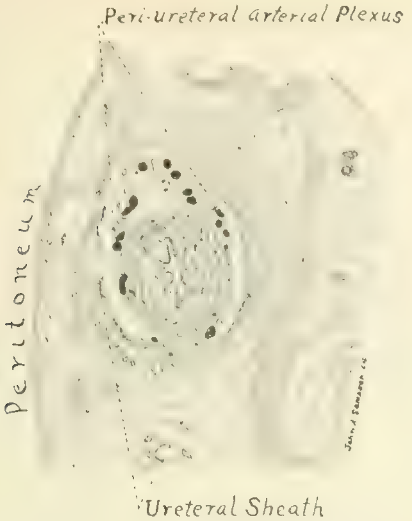


FIG. VII.—TRANSVERSE SECTION OF URETER TAKEN 1.5 CM. ABOVE ITS ENTRANCE INTO THE PARAMETRIUM, × 5.

The internal iliac artery was injected, 1 hour after death, with a 15 per cent gelatine colored with ultramarine blue. The large vessels of the periureteral arterial plexus are shown contrasting with the smaller branches in the walls of the ureter.

The ureteral sheath is derived from the tissue through which the ureter passes and in this situation is adherent to the peritoneum, and in freeing the peritoneum the ureter with its sheath is carried with the peritoneal flap. In uretero-vesical implantations the sheath and the peritoneum should be sutured to the bladder after implanting the ureter into the bladder, in order to relieve the tension of the implantation and to preserve the ureteral sheath and thus protect the ureter and its periureteral arterial plexus.

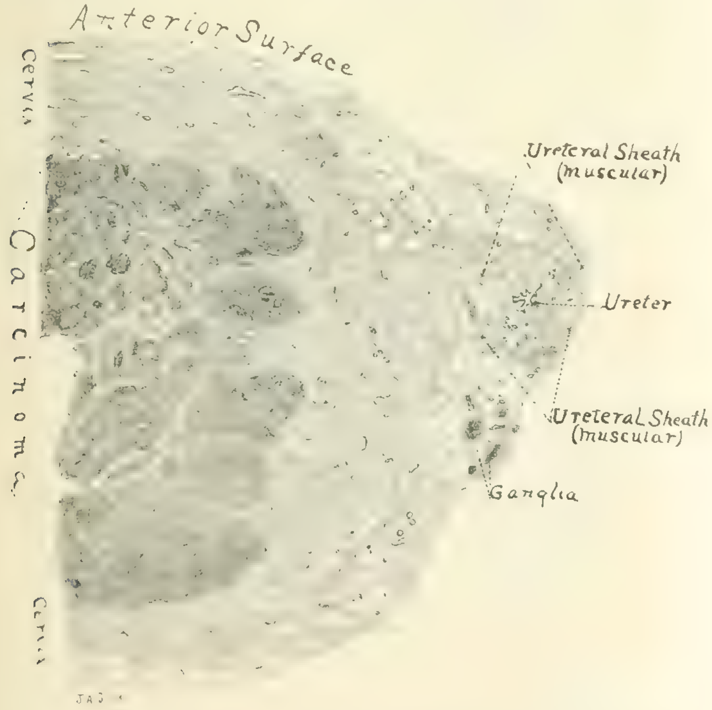


FIG. IX.—RELATION BETWEEN CARCINOMA CERVICIS UTERI AND THE URETER, WHERE THE GROWTH IS RESTRICTED TO THE CERVIX LOWER THIRD OF THE PARAMETRIUM, × 2¼.

From the same specimen from which Fig. VIII was drawn and about 1 cm. below the latter. As in the other section, the distance between the cervix and the ureter is very slight, only 2.5 mm. in this instance, and therefore it would take but very little involvement of the parametrium by the cancer for it to reach the ureter; and, unfortunately, this is the part first involved by the growth (see Figs. XIII and XIV). At this level the fibrous ureteral sheath has disappeared and its place is taken by a sheath of muscle bundles, the so-called sheath of Waldeyer.

Ganglia are also shown.

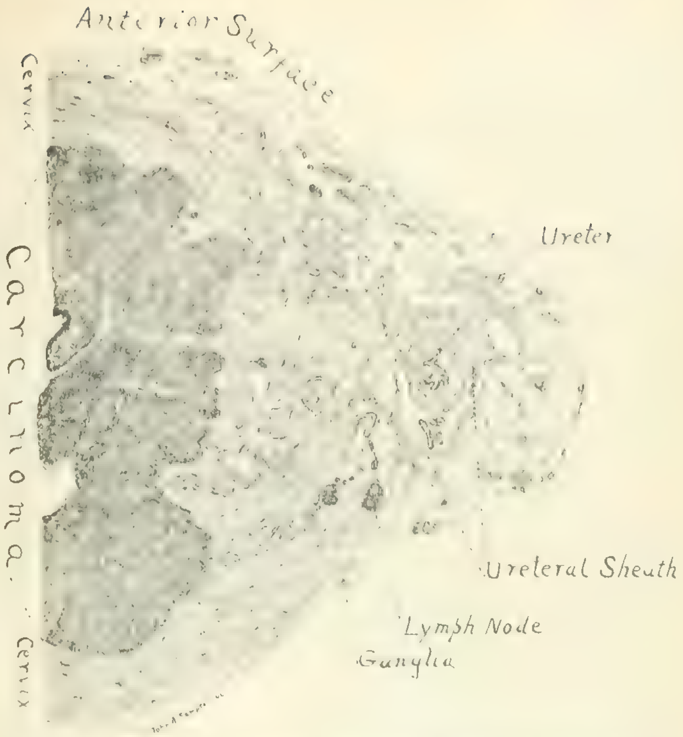


FIG. VIII.—RELATION BETWEEN CARCINOMA CERVICIS UTERI AND THE URETER, WHERE THE GROWTH IS RESTRICTED TO THE CERVIX. LOWER PORTION OF THE MIDDLE THIRD OF THE PARAMETRIUM, × 2¼.

Transverse section of the right parametrium and one-half of the cervix from a specimen of hysterectomy for carcinoma cervicis uteri, in which the lower portion of both ureters was sacrificed and the renal ends of the ureters implanted into the bladder. Gyn. No. 10,505. Gyn. Path. No. 6747.

Although there is a wide margin of the cervix about the growth, it would take but very little involvement of the parametrium either by direct extension of the growth or by metastases to reach the ureter, the distance between the two being but 3 mm.

The pelvic fibrous ureteral sheath is shown, surrounding the ureter and its arterial plexus.

A small parametrial lymph node is also shown, to which carcinoma may metastasize.

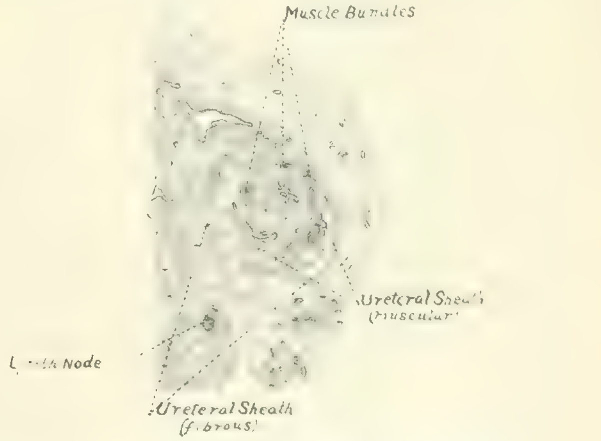
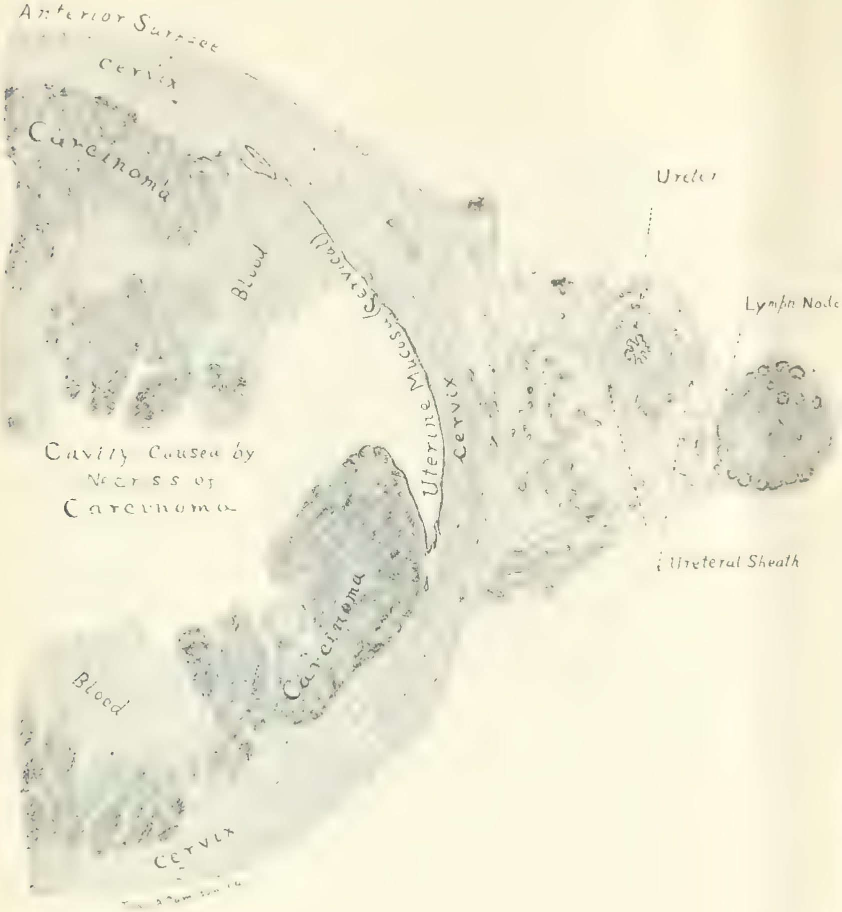


FIG. X.—RELATION BETWEEN THE FIBROUS URETERAL SHEATH AND THE MUSCULAR URETERAL SHEATH (WALDEYER'S), × 2¼.

Transverse section of a portion of the parametrium from the same specimen from which Figs. VIII and IX were made, and about half-way between the two.

In the outer wall of the ureter can be seen heavy muscle bundles, suggesting that Waldeyer's sheath arises from the ureter, as Disse claims, and not from the bladder, as one would infer from Waldeyer's description. Other muscle bundles can be seen just outside the ureter, the remnants of the muscular sheath seen in Fig. IX.

Outside the ureter and the remnants of the muscular sheath can be seen a fibrous sheath, which blends with the muscular sheath and gives rise to the fibrous sheath in Fig. VIII.


Anterior Surface
Cervix
Carcinoma
Blood
Uterine Mucosa (Cervical)
Cervix
Ureter
Lymph Node
Ureteral Sheath
Cavity Caused by Necrosis of Carcinoma
Carcinoma
Blood
Cervix

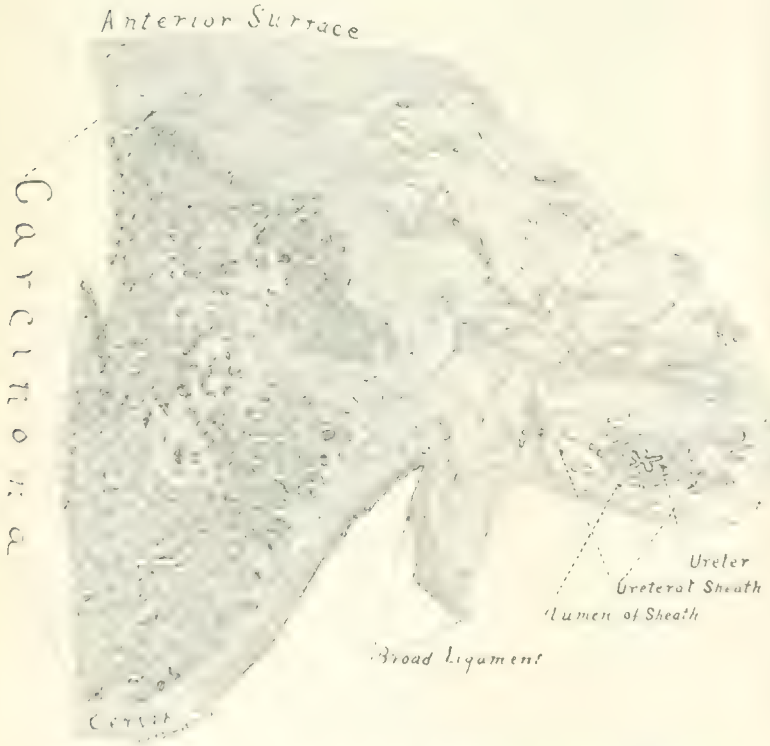

Anterior Surface
Carcinoma
Ureter
Ureteral Sheath
Lumen of Sheath
Broad Ligament
Cervix

Fig. XII. Shows the Relation between Carcinoma Cervicis Uteri and the Ureter in a Case where the Parametrium has been Invaded by the Growth. Upper Portion of the Parametrium. × 2¼.

Transverse section of the right parametrium and one-half of the cervix, from a specimen where both ureters were resected. Gyn. No. 9903. Gyn. Path. No. 6103.

The ureter in this section is over 1 cm. from the cervix and although the parametrium is involved at a lower level (see Fig. XIII), here it is free.

In the upper portion of the parametrium the ureters are further from the cervix than in the lower portion. In the former position the distance may be 2-3 cm., while in the latter, 3-6 mm. Unfortunately, the extension into the parametrium frequently occurs in that portion of the parametrium where the ureter is nearest the cervix.

Fig. XI. Shows the Effect of Distension of the Cervix by the Growth. Middle of Parametrium. × 2¼.

Transverse section of the right parametrium and one-half of the cervix from a specimen where both ureters were resected, as in the case represented in Fig. VIII. Gyn. No. 10,016. Gyn. Path. No. 6197.

The cervix was about half again as large as in the previous case and its walls are thinned out by the expansion of the growth. In this section the distance between the cervix and ureter is 8 mm., being greater than in Fig. VIII, where the cervix is much smaller, thus demonstrating the variability in the relation between the ureter and cervix; for in two cases in which the ureters were the same distance apart, in the one with the larger cervix the ureters would be nearer the cervix.

The fibrous ureteral sheath and periureteral arterial plexus is shown.

A parametrial lymph node is also shown, which in this instance was not involved.

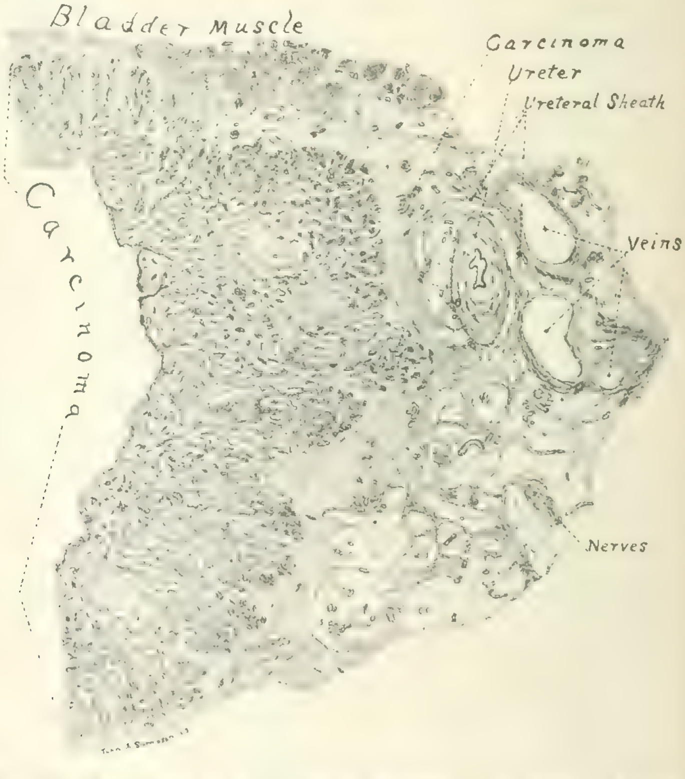

Bladder Muscle
Carcinoma
Ureter
Ureteral Sheath
Veins
Carcinoma
Nerves

Fig. XIII. Shows the Relation between Carcinoma Cervicis Uteri and the Ureter, in a Case where the Parametrium has been Invaded by the Growth. Lower Third of the Parametrium. × 2¼.

From same specimen from which Fig. XII was drawn, only in the lower third of the parametrium.

Compare with Fig. XII and note the more extensive invasion of the carcinoma at this level, how the bladder muscle is being invaded and the ureteral sheath, causing the latter to be hypertrophied, thus better protecting the ureter. Unfortunately, the ureter is nearer the cervix at this level than higher up in the parametrium.

The proximity of the ureter to the utero-vaginal plexus of veins is shown.

In such a case as this the freeing of the ureter without both leaving behind and injuring the periureteral arterial plexus would be very difficult.

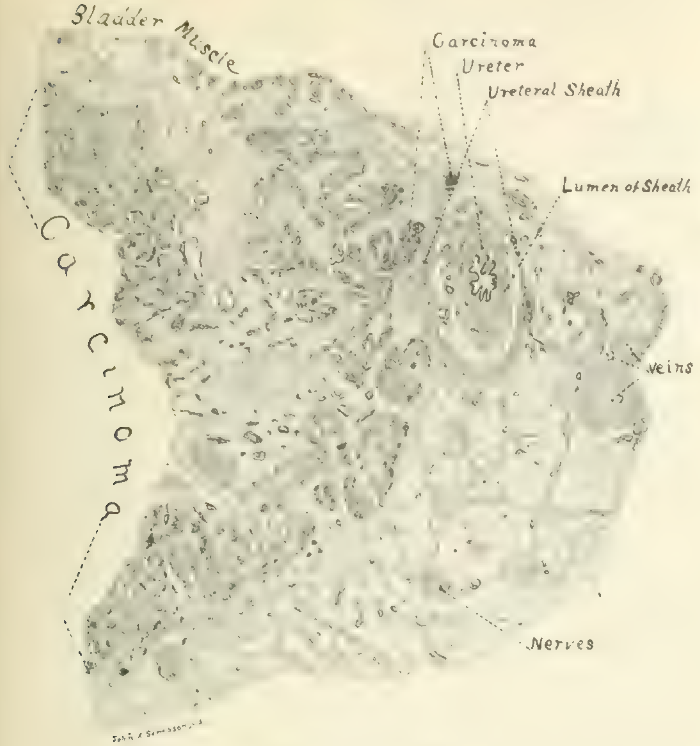

Bladder Muscle
Carcinoma
Ureter
Ureteral Sheath
Lumen of Sheath
Carcinoma
Veins
Nerves

FIG. XIV.—SHOWS THE RELATION BETWEEN CARCINOMA CERVICIS UTERI AND THE URETER, IN A CASE WHERE THE PARAMETRIUM HAS BEEN INVADED BY THE GROWTH. LOWER THIRD OF THE PARAMETRIUM, × 2¼.

Similar section as that shown in Figs. XII and XIII, from another specimen. Gyn. No. 10,494. Gyn. Path. No. 6715. Conditions are very similar to that shown in Fig. XIII.

The ureteral sheath has been invaded by the growth and as a result has become greatly hypertrophied, thus better protecting the ureter and its vascular plexus, which can be seen in cross section. Unfortunately, as in Fig. XIII, the portion of the parametrium involved is where the ureter is nearest the cervix. In such a case the freeing of the ureter without both leaving cancer behind and injuring the periureteral vascular plexus would be very difficult.

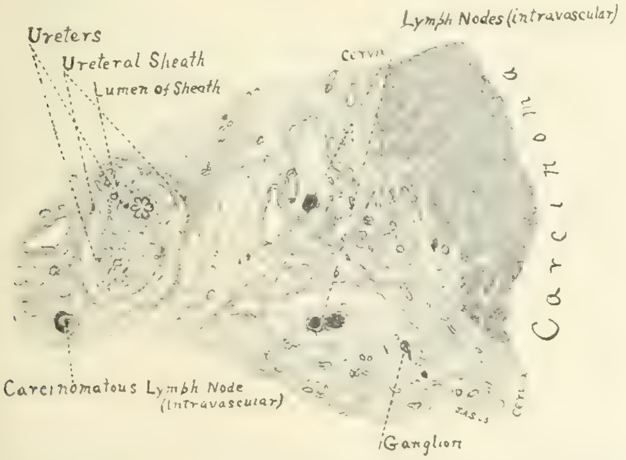

Ureters
Ureteral Sheath
Lumen of Sheath
Lymph Nodes (intravascular)
Cervix
Carcinoma
Carcinomatous Lymbh Node (intravascular)
Cervix
Ganglion

FIG. XVI.—SHOWING RELATION BETWEEN THE METASTASES TO THE INTRAVASCULAR PARAMETRIAL LYMPH NODES AND THE URETER. MIDDLE OF PARAMETRIUM, × 2¼.

Transverse section of left parametrium and portion of the cervix. Gyn. No. 9860. Gyn. Path. No. 6074. The double ureter is situated over 1 cm. from the cervix, and has but one ureteral sheath instead of two, thus suggesting that the sheath is derived from the pelvic structures and not from the ureter.

Four intravascular lymph nodes are shown, *i. e.*, lymph nodes apparently situated within the lymph channels. The one situated lateral and posterior to the ureters is carcinomatous.

The use of the microscope alone could diagnose cancer in the parametrium in this case.

Hysterectomy mesial to the ureter would have left the carcinomatous node in the pelvis.

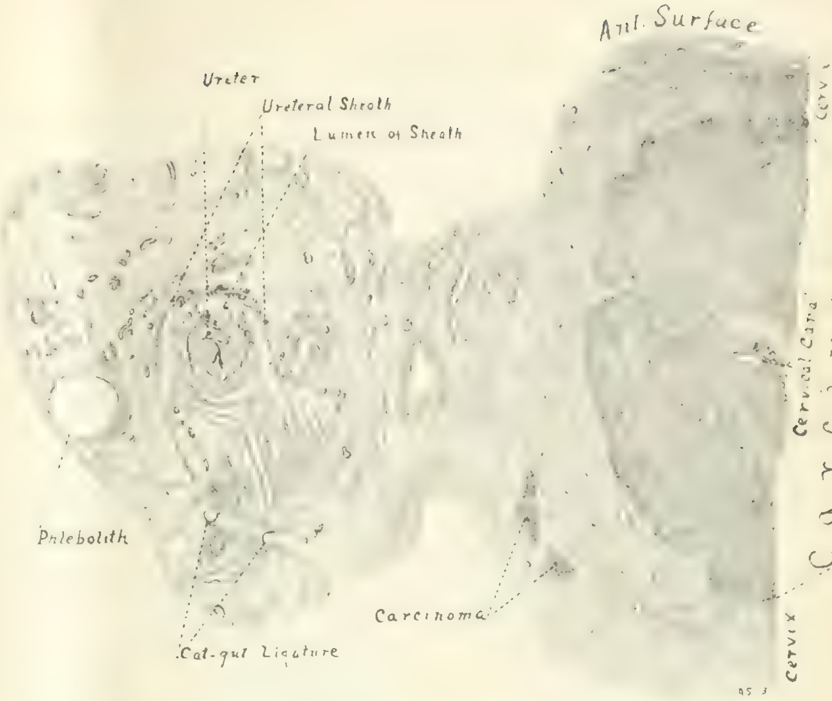

Ant. Surface
Cervix
Ureter
Ureteral Sheath
Lumen of Sheath
Carcinoma
Cervical Canal
Phlebolith
Carcinoma
Cat-gut Ligature
Cervix

FIG. XV.—SHOWING THE RELATION BETWEEN PARAMETRIAL METASTASES AND THE URETER. UPPER THIRD OF THE PARAMETRIUM, × 2¼.

From same case as sections represented in Figs. VIII and IX, left side instead of right.

The ureter is over 1.5 cm. from the cervix instead of 3 mm., as in Fig. III. This is accounted for by the fact that it is in the upper portion of the parametrium where it may be 2 or 3 cm. from a normal cervix.

The carcinoma in the parametrium just outside of the cervix may be a metastasis to a lymph space or possibly from a direct extension of the growth. I was unable to find any connection with the primary growth.

A phlebolith is shown lateral to the ureter, which in a skiagraph could be mistaken for a ureteral calculus and during an operation might be taken for a lymph node.

Note how a catgut ligature could easily occlude the ureter although not actually inclosing it.

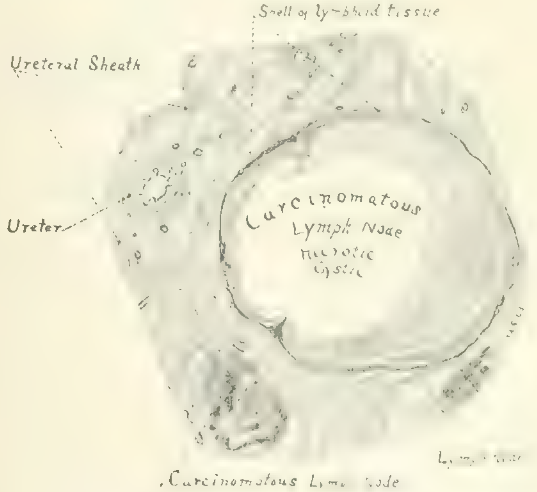

Shell of lymphoid tissue
Ureteral Sheath
Ureter
Carcinomatous Lymph Node necrotic cystic
Carcinomatous Lymph Node

FIG. XVII.—SHOWING THE RELATION BETWEEN CARCINOMATOUS PARAMETRIAL LYMPH NODES AND THE URETER, × 3.

Same case as one represented in Fig. XVI.

This carcinomatous lymph node, which had become necrotic and cystic, is situated lateral to the right ureter and is probably the node sometimes found near the crossing of the uterine artery and the ureter as shown in Fig. XI.

The ureteral sheath is shown and the hypertrophy of its wall next to the carcinomatous nodes thus acting as a protection to the ureter. A small carcinomatous node is also shown and one not involved by cancer.

23. Amann: Ein neuer Weg zur Extirpation der carcinomatösen Uterus. Cent. für Gyn., 1901, XXV, 744-750.

24. Mackenrodt: Die Radikaloperation der Gebärmutter-Scheidenkrebses mit Ausräumung des Becken. Cent. für Gyn., 1901, XXV, 789-794.

25. Budinger: Beiträge zur Chirurgie des Ureters. Archiv für Chirurgie, 1894, XLVIII, 639-682.

26. Witzel: Extraperitoneale Ureterocystostomie mit Schrägkanal-bildung. Cent. für Gyn., 1896, XX, 289-293.

GEORGE CHEYNE, AN OLD LONDON AND BATH PHYSICIAN. (1671-1743.)[1]

By Thomas McCrae, M. D., M. R. C. P.,

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"*The palate kills more than the sword.*"—Old Proverb.

The advice has been given to the younger of our profession to leave the reading of new books to the older men and to devote ourselves to the writings of previous generations. By so doing we may be delivered from what has been termed "an inapt derision and neglect of the ancients." Perhaps too truly might the words of Job be applied to some of us, "No doubt but ye are the people and wisdom shall die with you." However that may be deserved, it does not require much study of the works of those who have gone before to realize that wisdom was not born with us. Much wisdom is of all time and the fact cannot be brought home too strongly. To some of us the acceptance of this comes slowly. There are few impressions stronger than the personal realization that many ideas we are apt to think peculiar to our own time have long since been old. To find certain things dating back to Hippocrates gives one a comforting sense of the permanence of the profession.

There are certain follies common to all times. Many faults of previous generations are those of ours, and the warnings are no less worthy of attention now than then. The prophets in all ages have showed the way for the feet of others. It is with one of these, who lifted his voice specially against intemperance in eating and drinking, that this sketch deals; one who has been called the preacher of moderation.

George Cheyne was one of the Scotchmen who found the "road to London," which has been so well trodden before and since. There have been many in our profession in London who have come from north of the border. Cheyne was one of them. He had characteristics sufficient to distinguish him in any company; not a great man but one who in spite of much infirmity worked long and well. As we shall see, he was in many ways an oddity—at times almost grotesque—but always working and striving for the truth as he saw it. At times he brings Dr. Johnson to mind, and we do not think the less of him for his peculiarities.

There is considerable material available relating to Cheyne. Dr. Greenhill[2] has written a short sketch of his life; the literature of his day and subsequent times contains many references to him, but one of the best records is by himself. He gives his own case in detail in one of his works. As a rule the record of symptoms written by patients themselves is only too tiresome, but Cheyne's throws much light on his characteristics and is of much help in following his life. We are taken into his confidence both here and in many other places in his writings and are thereby enabled to understand much of his curious history.

I. Life.

George Cheyne[3] was born in Methlick in Aberdeen, Scotland, in 1671. Of his immediate family we have little information. He probably belonged to the old Aberdeen family of Cheyne or Le Chien, whose records go back to the thirteenth century. We know little of his early education except that it must have been liberal and thorough. He was intended for the church and his early studies were directed to that end. This insured a good classical training and must have included an extensive study of mathematics and philosophy. He had gained a wide reputation for his mathematical knowledge at an early age. For a time he was a tutor to the Earl of Roxburghe. Why he forsook theology for medicine we are not definitely told, but it seems likely that he came to Edinburgh to study and there fell under the influence of a most unusual man and one of the leaders in medicine of the day. This was Dr. Archibald Pitcairne, a man of great learning, a writer of epigrams and Latin verses, one who did much for the revival of classical learning, but most unorthodox in his religious views and perhaps hardly the best guide for a young theological student. However, Cheyne seems to have taken the good and escaped the evil. There can be no doubt of the influence exercised on him by Pitcairne. In one of his early writings he says of Pitcairne: "I owe him all the acknowledgments in the world, for if ever I shall be able to do anything in medicine it was by him the foundations were laid and by his encouragement and conversation I profited more than by that of all mankind beside." There seems little doubt of Pitcairne having been Cheyne's preceptor in medicine, and some account of him and the condition of medicine at that time will throw light on Cheyne's opinions.

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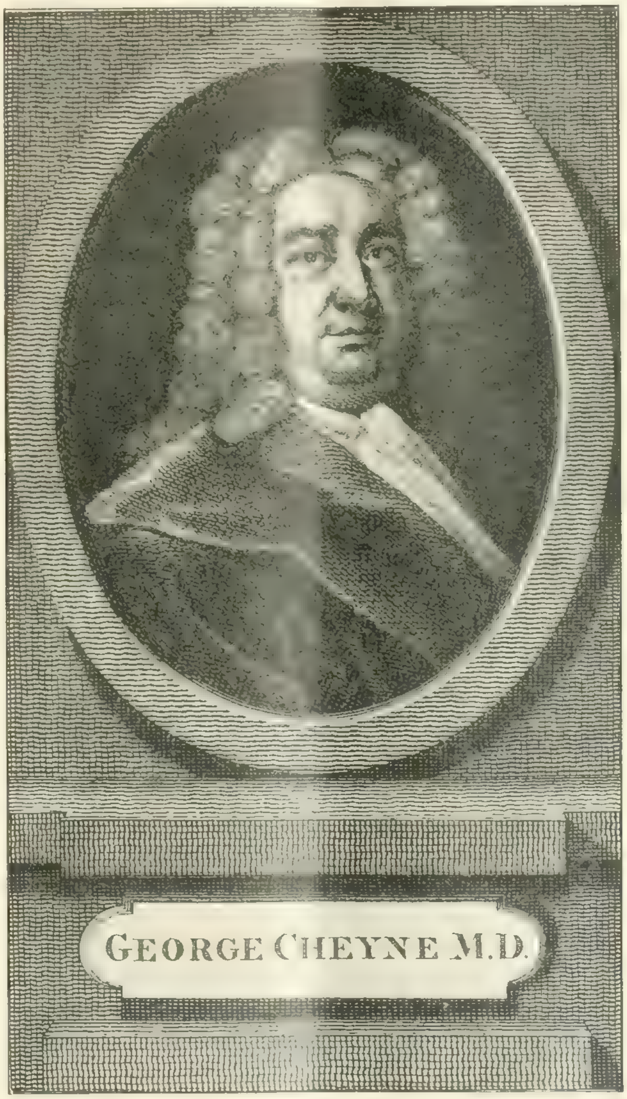
[1] Read before the Johns Hopkins Hospital Historical Club, March 9th, 1903.

[2] Life of George Cheyne, M. D., by W. G. Greenhill, Oxford, 1846. This was one of a series of Christian Medical Biographies.

[3] It may be noted he is not the Cheyne of "Cheyne-Stokes" fame. That was John Cheyne, born near Edinburgh in 1777 and who practiced in Dublin. He was probably of the same family as the subject of this sketch.

Archibald Pitcairne had been destined for the church but forsook it for the study of law. He went to Paris and there was attracted to medicine, but returned to Edinburgh and took up the study of mathematics in which he attained some fame. Later he returned to France and took his degree in medicine at Rheims in 1680. On returning to Edinburgh he at once took a prominent position and was one of the founders of the College of Physicians in 1681. For some years before this an attempt had been made to carry on medical teaching in Edinburgh. Pitcairne evidently took strong interest in this, and in 1681 he and Dr. Monteath—probably a surgeon—offered to attend the occupants of a house of detention if the bodies of the unclaimed dead might be used for dissection. In 1682 a free dispensary was opened. This was undoubtedly used for teaching and there are records of clinical examinations being held there. The first examination for the license to practice was held in 1683. It seems probable that Pitcairne gave lectures in medicine about this time. He was one of the men making an earnest effort to raise the standard of medical education and to pass regulations which would allow only those properly qualified to practice.


GEORGE CHEYNE M.D.

Pitcairne published some medical works, notably one vindicating Harvey's claim to the discovery of the circulation of the blood. In 1685 he was appointed to the Faculty of Medicine. In 1692 he was called to Leyden to fill the chair of medicine. This he resigned in 1693 and returned to Edinburgh.[4] He resumed his prominent position in the profession and doubtless continued his medical teaching. Cheyne evidently became one of his students. That both were celebrated mathematicians was probably a bond, for Cheyne seems to have gained very extensive fame for his mathematical researches at an early age.

Medical opinions at this time were in an unsettled state. Many of the writings of the time show a curious mixture of mathematics and philosophy. A school of medicine had arisen termed the "Iatromechanical or mathematical," in opposition to the so-called chemical school. Its adherents attempted to explain all the conditions in the body, normal or not, by principles applicable only to inorganic matter. The body was considered to be a machine composed of a great number of tubes or systems of canals. Medicine was therefore a branch of mathematics. Bellini, Borelli and Boerhave all held these views. The great advances in mathematics had probably influenced many in accepting these beliefs. It does not seem strange that Pitcairne and Cheyne, with their thorough mathematical training, should have adopted them. But Cheyne was not a blind adherent. He pointed out that the circulation of the blood could not be explained in any such way. The combination of medicine and mathematics has been described as of "the most exact of sciences with the least exact of arts." But perhaps medicine gained some accuracy from the union.

About 1691 Dr. Andrew Brown introduced some of Sydenham's views on fevers into Edinburgh. The profession became involved in a serious quarrel over these and the dispute threatened to destroy the College of Physicians. The controversy was carried on vigorously, pamphlet answered pamphlet, and soon both personal and political strife were added. Pitcairne was one of the strongest supporters of the mathematical school. He became involved in a dispute with Dr. Brown, to whose aid a Dr. Oliphant had come. It is in this strife that we find Cheyne first entering into print. Pitcairne had been attacked for his views on fevers and he planned a general rejoinder. This was to be done by three men; Cheyne and another were to provide the theory while Pitcairne wrote the practical part. But for some reason only Cheyne's article saw the light. It is entitled "A New Theory of Fevers" and was published in 1702. The author says that it was written in haste and was a "raw and inexperienced performance." He says, "I was very young in the Profession and lived in the country. But in a few days I brought in my part finished." It seems to have aroused much interest and went to a fourth edition. To this Oliphant replied, both pamphlets being published anonymously. Cheyne then published a rejoinder from which some extracts will show the style of controversy of the time. This is called "Remarks on the Late Pamphlets Written by Dr. Oliphant against Dr. Pitcairne's Dissertations and the New Theory of Fevers, etc." He opens with some reflections: "No men are more miserable than authors. Let them behave with all the sense and address imaginable, they shall move the spleen of the would-be's, these Insects who make the greatest splutter and noise on the face of the earth. If they write for the whole herd, they raise enemies of the common ones, and if they lay in for the few, they are rebuked for obscurity and pride." Therefore, he concludes, "To write well is only tolerable but not to write at all is the wisest thing a man of sense can do." He for himself would never have entered into the controversy, but his friend, Dr. Pitcairne, had been "assailed by two bloody-minded beasts of prey." He acknowledges some heat in his remarks but how can he do otherwise when his opponent is unable to "manage a debate without weapons from Billingsgate?" There is much sarcasm such as this: "Edged tools ought to be kept from children and madmen and C. O. (Oliphant) should no more be permitted to use pen and ink than to swallow ratsbane and hemlock, for the one will no more infallibly take away his life than the other his reputation." The end of this most amusing pamphlet, only a few extracts of which have been given, is as follows: "That C. O. is an ignorant pretender, an unjust detractor and a false friend; and that his translators are incompetent judges and meddling coxcombs, *qua erant facienda.*"

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[4] The reason for Pitcairne's resignation was his engagement to a woman whose family refused to allow the marriage if he continued to live in Leyden. He gave up the chair. Boerhave, who had been a pupil of Pitcairne's, was appointed some years afterwards. There was a close medical bond between Edinburgh and Leyden and many Scotch students studied under Boerhave.

It is interesting to find Dr. John Brown, in his essay on "Dr. Andrew Brown and Sydenham," referring to the bundle of pamphlets produced in this Edinburgh controversy. "Amid the dreary unreadable rubbish in this old bundle there is a most characteristic onslaught by the famous Dr. George Cheyne upon Dr. Oliphant—it is his pugilistic, honest, reckless style, and is valuable for the testimony he (at this time) a free thinker in religion and a mathematical and mechanical physician, gives to the strictly divine origin of animal species." Dr. Brown here refers to Cheyne's religious views. For a time he was apparently a free thinker. This was doubtless due to the influence of Pitcairne, who held most unorthodox views. It should be said that Cheyne retracted subsequently and made apology for his articles against Oliphant, as also for some of his later works.

The place of Cheyne's graduation was for a long time in doubt. Dr. Greenhill was unable to determine it. The record has been found in Aberdeen. It says, under date of September 8, 1701, Mr. George Cheyne to be Doctor of Medicine, gratis "because he's not onely our owne countryman and at present not rich but is recommended by the ablest and most learned Physitians in Edinburgh as one of the best mathematicians in Europe and for his skill in medicine he hath given a sufficient indication of that by his learned tract *De Febribus* which hath made him famous abroad as well as at home and he being just now goeing to England upon invitation from some of the members of the Royal Society in all probability he may prove ane ornament to our nation as well as to our Society."[5] This note is of interest as giving some idea of Cheyne's position and also suggesting some reason for his venturing to London. At this time Edinburgh did not grant degrees in medicine.

In 1702 Cheyne moved to London. In the same year he was admitted a Fellow of the Royal Society. The records of the Society give his date of election as March 18, 1701, and his admission as May 6, 1702. These dates show his election before he left Scotland, and in fact before he was given his degree in medicine (the Royal Society records say "afterwards M. D."). His admission to the Royal Society may have influenced his coming to London. It seems surprising that such a young man should have been so honored and suggests that Cheyne must have had a wide reputation for his work in mathematics. No reason for his election could be found recorded in the archives of the Society.

In the next year he published "Fluxionum Methodus Inversa." This was a treatise on integral calculus which he himself terms "a book of abstracted geometry and algebra brought forth in ambition and bred up in vanity." The work is said to be evidently that of a mathematician well advanced for that day. But later he considered these as merely "barren and airy studies," and observes, perhaps with regret, that these are "bewitching contemplations, proper only for public professors and those born to estates, and who are under no outward necessities." In the next year Abraham De Moivre, a celebrated mathematician, criticised this work severely. Cheyne replied in a bitter way which he later regretted and for which he made a frank apology. In 1705 he published his work on "Philosophical Principles of Natural Religion." This was the first part of what was evidently intended to be a more ambitious work than any of his previous writings. It was composed for the Earl of Roxburghe. It contains nothing new and has been described as the "barren speculations of an obsolete school of medical thought." In 1715 he published what is apparently a continuation of this work, "Philosophical Principles of Revealed Religion, Containing the Nature and King of Infinities, their Arithmetic and Uses." This and the previous work were published together. In them he mixes mathematics and theology.

Here we may turn to Cheyne's account of himself as given in the report of his own case in "The English Malady." This is too long to give in full but may be extracted. His youth he passed in close study and in great temperance, leading a sedentary life, yet at times he indulged in agreeable company and good cheer. The signs of his future malady were evident at that time for he found his digestion easily disturbed. He was subject to tremor and a "disposition to be easily ruffled on a surprise." On his coming to London, at the age of thirty, he changed his mode of life and associated with "bottle-companions and free-livers," for whose friendship it was only necessary to be able to "eat lustily and swallow down much liquor." He frankly avows that he adopted this mode of life to help him in practice. He evidently became very popular and likewise very stout, but in a few years his health became affected and he grew "excessively fat, short-breathed, lethargic and listless." Soon he was seized by a fever from which he rapidly recovered under the use of bark. After a year of only moderate health he was taken suddenly with a vertiginous paroxysm, "so extremely frightful and terrible as to approach near to a fit of apoplexy, and I was forced in it to lay hold on the posts of my bed for fear of tumbling out, as I apprehended." For this he was bled and given large doses of bark, without much help, for "it turned to a constant violent headache, giddiness, lowness, anxiety and terror, so that I went about like a malefactor condemned or one who expected every moment to be crushed by a ponderous instrument of death, hanging over his head." This might be understood as merely a description to give some idea of his misery, but from writings elsewhere the fear of death appears to have been a phobia with him. Soon all his "bouncing, protesting, undertaking companions" forsook him and "retired to comfort themselves with a cheer-upping cup, leaving me to pass the moments with my own apprehension and misery." His conclusion to this chapter must be quoted in full: "I was forced to retire to the country quite alone, being reduced to the state of Cardinal Wolsey, when he said that if he had served his Maker as faithfully and warmly as he had his Prince, He would not have forsaken him in that extremity; and so will every one find when union and friendship is not founded on solid virtue and in conformity to the divine order but in sensual pleasures and mere jollity. This silly circumstance I mention because I thought then it had some share in my succeeding melancholy."

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[5] Officers and Graduates of University and King's College, Aberdeen, 1510-1860. Edited by Peter Anderson. The New Spalding Club, 1893.

He retired to the country, carried a seton for many months and turned himself into an apothecary's shop. In spite of all his infirmities his mind continued bright and active, while the time was favorable to much meditation, so that we find him turning to set his spiritual affairs in order, believing that he was soon to enter into an "*unknown state of things.*" He consulted a clerical friend who recommended many religious works for his consideration. These he studied faithfully and his final resolution may be quoted: "To neglect nothing to secure my eternal peace, more than if I had been certified I should die within the day; nor to mind anything that my secular obligations and duties demanded of me less than if I had been insured to live fifty years more." Dr. Johnson is said to have recommended this resolution to "be imprinted in every mind." The following spring he was advised to try the Bath waters, which he did with some benefit but soon relapsed. Then he went to Bristol to try the waters there. These, with strict diet and exercise, improved his state, but to no great degree. Here some friend told him of a wonderful cure wrought by Dr. Taylor of Croydon by a milk diet. It is easy to imagine that the patients in Bristol at that time differed in no way from those of to-day. We know how this cure and that is passed from mouth to mouth and how eagerly taken up by such as Dr. Cheyne describes as hypish people. He reflected on Sydenham's and Pitcairne's opinion of the value of milk in various disorders, and accordingly we find him going to see Dr. Taylor, who lived on milk alone. Back to London came Dr. Cheyne and promptly arranged for a supply of milk, which with seeds, bread, mealy roots and fruit composed his dietary. After six months of this he was much reduced in flesh and improved in health but suffered from constant pain in the stomach (probably due to hyperacidity, we should suppose from the account of his symptoms). During all this time he kept at work, in the summer in Bath and in the winter in London, devoting himself more especially to chronic and nervous cases, all of which, he says, who can afford it, arrive at some time in Bath.

After this he returned to ordinary diet, never taking above one quart or three pints of wine a day (a commentary on the drinking habits of the day when this was considered moderate), and had good health for many years. But with this he gradually grew in bulk until he weighed 32 stone (448 pounds). This gave him great distress and he was hardly able to get about. He could not walk up more that one pair of stairs without "extreme pain and blowing," and if he had any distance to walk his servant had to follow him with a stool for him to rest on. It is probably about this time that the description given of him in "The Gold-Headed Cane" applies. A consultation on Bishop Burnet is described. He was a relative of Dr. Cheyne, by whom he was attended. "On the other side was Dr. Cheyne, a Scotchman, with an immense broad back, taking snuff incessantly out of a ponderous gold box, and thus ever and anon displaying to view his fat knuckles; a perfect Falstaff, for he was not only a good portly man and a corpulent, but was almost as witty as the knight himself, and his humour being heightened by his northern tongue, he was exceedingly mirthful. Indeed, he was the most excellent wit of his time, a faculty he was often called upon to exercise, to repel the lampoons which were made by others upon his extraordinary personal appearance."

Soon once more his health declined and he suffered from many troubles, among them severe attacks of erysipelas, which occurred at intervals of three months for two years. His first attack was very severe and he greatly feared a fatal issue. However, he gradually recovered fair health for a time on his previous diet of milk and vegetables. Soon an attack of the gout came with which he suffered for some weeks, and after this all his old symptoms returned, "sickness, reaching, lowness, watchfulness, eructation and melancholy; that life was no longer supportable to me and my misery was almost extreme." Then follows a most graphic description of his sufferings. His symptoms were "a perpetual anxiety and inquietude, no sleep nor appetite, a constant reaching, gulping and fruitless endeavor to pump up flegm, wind or choler, day and night, a constant colick, an ill taste and savor in my mouth and stomach; a melancholy, fright and pannick *wherein my reason was no use to me;* so that I could scarce bear the sight of my patients or acquaintances, that had not been daily about me, and yet could not bear being a moment alone, every instant expecting the loss of my faculties or life." There is no difficulty in diagnosis here; one need not hesitate. His remedies were as many as his symptoms—emetics, tobacco, bark, Bath waters, fœtids, gums, volatiles and viper's powders among others. At last he takes to opiates, "which I knew were a slow poison but one will stop at nothing for even a moment's respite in such extremities." During this time he kept at work and went about, though in great misery. His friends pressed him to go to London, which he finally did, and consulted some of his London colleagues. Six of them were called to the consultation, among whom were Dr. Arbuthnot and Dr. Mead. They advised him to stop the opiates and gave some general directions. He probably acted on the first but made up his mind to go back to his old regimen. This he did and practically kept to it for the rest of his life. Even an ounce or two of animal food was enough to give him suffering. After two years of gradual recovery he was able to consider himself well.

Regarding his diet he expressly states that no one is likely to be brought to it who has not suffered greatly. But he is careful to state that the common diet with temperance is best for the generality. Even after this he at times indulges too freely in his diet of vegetables and nuts, with warnings in the form of attacks of gout or erysipelas. His ordinary diet in the latter part of his life was milk, tea, coffee, bread, butter, cheese, fruits, seeds, vegetables—at no time flesh or alcohol.

Lastly he addresses some words to others who may like himself be afflicted. Those who may do as he has done are likely to be only "low valetudinary, dying, miserable creatures," but he expects only derision from "the brave, the bold, the intrepid, the heroic and who prefer death with a bounce to life on such conditions as I propose." Aptly does he observe that "Milk and honey was the complexion of the land of promise, and vegetables the diet of the Paradisiacal state."

During this time he published an essay on the Gout and an essay on Health and Long Life. These were written for the public and it is not strange that they should have excited attention, much of it ridicule. Cheyne was apparently the butt of many jokes and jests but seems to have been able to defend himself. He was represented as holding absurd views as to diet, whereas over and over again he points out that his advice to the healthy is to leave well alone. The attitude of many towards him is well put by Wesley, who says of one of his works, "It is one of the most ingenious books which I ever saw. But what epicure will ever regard it, for the man talks against good eating and drinking?" Young in the "Epistles to Pope" says,

> " three ells round huge Cheyne rails at meat."

He seems to have taken these sallies in good part and his usual answer might be summed up in the words of the old proverb "The proof of the pudding is in the eating." If one is well, leave well alone. If one is sick, the remedy is simple and can easily be tried by experience. As he says, "surely he knows the road better who has gone to and come from the Cape of Good Hope, and tried all the soundings, rocks, shelves and winds, than those who have only seen them in the map." Some of his exchanges with professional brethren were serious, others were amusing, such as his reply to Dr. Wynter, which may be quoted.

Dr. Wynter to Dr. Cheyne.

"Tell me from whom, fat-headed Scot,
Thou didst thy system learn;
From Hippocrates thou hast it not
Nor Celsus nor Pitcairn.

Suppose we own that *milk* is good
And say the same of *grass;*
The one for babes is only good,
The other for an *ass.*

Doctor! one new prescription try,
(A friend's advice forgive)
Eat grass, reduce thyself and *die,*
Thy *patients* then may *live.*"

To which Dr. Cheyne made answer:

"My 'system,' Doctor, is my own,
No tutor I pretend;
My blunders hurt myself alone,
But *yours* your dearest friend.

Were *you* to milk and straw confined,
Thrice happy might you be;
Perhaps you might regain your mind,
And from your wit get free.

I cannot your prescription try,
But heartily forgive;
'Tis natural you should bid *me* die
That you yourself may live."

Cheyne had a large practice, working in London during the winter and at Bath during the summer. Many of his patients suffered from like maladies to his own. Among them was David Hume, who at the age of eighteen had a severe attack of depression for which he was treated successfully by Cheyne. Pope was under his care, for he writes, "Dr. Cheyne was of Mr. Cheselden's opinion that bleeding might be frequently repeated with safety, for he advised me to take four or five ounces of blood every full moon." Samuel

Richardson appears to have been one of his intimate friends. There are a number of letters from Cheyne to him, in some of which is advice regarding the writing and plot of "Pamela." Richardson suffered for some years from nervous disorder and was under Cheyne's care. He had evidently been put on restricted diet but longed for the flesh pots of Egypt, and we find Cheyne rallying him on his lack of courage and making the attempt to cut down his diet gradually—"You must absolutely *die* to them that you may *live.*" Cheyne writes encouraging letters to him when progress seemed slow: "You must have faith, perseverance and patience, which are sublime *Christian* as well as *nervous* virtues." One passage is of interest as giving Cheyne's ideas of the "hyp." "You have quite a wrong notion about the hyp, as in truth all but sensible physicians have. We call the hyp every distemper attended with lowness of spirits, whether it be from indigestion, head pains or an universal relaxed state of the nerves with numbness, weakness, starting, etc." He strongly advises Richardson to have a hobby and suggests billiards as very suitable.

The literature of the day contains many references to Cheyne. There are several in Boswell's Life of Johnson. There are many stories of Cheyne and Beau Nash. Some of them are almost classical.[6] Although intimate with many of those belonging to the College of Physicians of London, Cheyne never became connected with it. The latter end of his life was peaceful and he died at Bath in 1743, aged seventy-two years. He was buried at Weston near Bath. A recent search failed to find his grave in the churchyard there. Several references to his death are preserved. One written by a patient—whose malady is evident—may be quoted.

> "He saw, heard, pitied, paused and smiled serene,
> Aid in his eye! Compassion in his mien!
> Heard me long years of aidless anguish moan!
> Physick's last labours! dear bought skill unshown!
> Heard my sad sighing heart's long weary tale,
> Traced its dark cause and hit the unheeded nail.
> Life shall henceforth and Health be yours, he cryed.
> Bear but a few short weeks. He said—and died!
> Would I were now the ghost I soon must be!
> Haste my new Doctor, Death, and set me free."

In concluding the account of his life the words of Socrates relating to Herodicus seem to be specially appropriate: "for he had a mortal disease which he perpetually tended, and as recovery was out of the question, he passed his entire life as a valetudinarian; he was in constant torment when he departed in anything from his usual regimen, and so dying hard, by the help of science he struggled on to old age."—Plato, Republic, III, 406.

II. WRITINGS.

In considering these it has to be kept in mind that they were intended rather for the public than for the profession. At that day this was quite commonly done and not thought improper. Yet there was evidently some criticism of this, for in the preface of one of his books Cheyne defends himself against the charge of writing for the public. In saying that he does not believe his professional brethren would object to his trying by good advice to reduce the *materia morbifica,* he proceeds: "I never entertained the most remote vanity to think any endeavor of mine would make so considerable a change in the nation; especially where the Devil, the World and the Flesh were on the other side of the question."

It seems best to consider his works separately. They are nearly all alike in containing some philosophy with a flavor of mathematics in addition to the more strictly medical material. Religious matters are frequently considered, for Cheyne showed to some extent "the angelical conjunction of medicine and divinity." But throughout he preaches the great lesson of temperance both in eating and drinking.

The New Theory of Fevers, 1702.—This was his first work and was written in defense of his preceptor, Dr. Pitcairne. The name of the author was not given, for Cheyne himself felt it was "raw and inexperienced." This work contains little of interest. Mathematics occupy a large place. The theory is set forth that fever is due either to obstruction or dilatation of the canals of the body. In later years he did not consider it worthy of revision but threw it by "as unripe fruit and suffered it to be as if it had never been." The most striking thing about this work is that it was written by a medical student. In the controversy among the profession of Edinburgh which called forth this book and to which reference has already been made, the pamphlet mentioned in reply to Dr. Oliphant was produced.

In the next year, 1703, he published a mathematical work, "Methodus Fluxionum Inversa." This was the means of engaging him in controversy again, which called forth a frank and sincere apology in later years. In 1705 appeared the first part of his work on the "*Philosophical Principles of Religion.*" This dealt with the association of natural philosophy and religion. These were apparently some of the lectures he had prepared for his pupil, the Earl of Roxburghe, and were used in some of the universities. In 1715 a second edition was published with an addition on revealed religion.

An Essay of the True Nature and Due Method of Treating the Gout.—This was published in 1720 and ran through eight editions. It was written partly by accident. He gave directions to his friend Richard Tennison, who had gout, as to how he should manage himself. Unauthorized copies were made, and to prevent these from being published he was compelled to bring out the work himself. He gives his idea of the nature of gout. The vessels of the body are tubes, which may be small by nature or have become so by old age. Salts collect and obstruct these tubes, pain results as the channels are smaller. This is worse at the joints, for here the tubes are smaller and are subject to compression by the prominence of the bones. Gout is usually in strong people of good constitution for their vessels are stiff and springy. It is due to the abundance of tartarous, urinous or other salts introduced into the blood. Of these salts he says they seem neither to perish nor to be begotten. An attack of acute gout is an effort to throw off the abundance of salts through narrow and stiff strainers. Therefore the methods of cure are, (1) widen the vessels and (2) lessen the quantity of salts introduced. Hereditary gout can only be helped, but acquired gout is easier of treatment and especially by diet. The treatment comes under (1) exercise, which must not be too much or we have greater hunger and more food taken, (2) diet, under which the red meats are forbidden, (3) evacuations, such as purges, (4) drugs, of which sulphur is probably the best. Opium is only to be given for pain, (5) waters, especially those of Bath. He advises cold bathing in certain cases. He discusses the manifestations of irregular gout at some length, under which he includes all symptoms other than those in the joints. These rarely come alone, for irregular gout usually brings the stone; "it seldom comes to pass that any one is much troubled with the gout but he has the stone at last." He considered the chalk stones and calculi to be essentially the same.

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[6] Nash was asked by Cheyne if he had followed his last prescription, but replied in the negative, saying, "If I had I should certainly have broken my neck, for I threw it out of a two pair of stairs window."

On one occasion Nash brought a friend to consult Cheyne about an abdominal swelling. Cheyne pronounced the swelling to be due to a collection of water and said it should be tapped. "It cannot be water," said the patient, "it may be wine." "No, no, my good fellow," said Nash, "if it had been wine you would long ago have tapped it yourself."

Throughout the work he preaches temperance, which alone can prevent the gout or effectually cure it. With that he extols the use of Bath waters. In conclusion he agrees with Sydenham (they agreed also in having had personal experience of the disease) that treatment is of but little avail. "For let us, or our brethren the quacks, brag what we will,

> Tollere Nodosam nescit Medicina Podagram."

An Essay of Health and Long Life.—This was published in 1724. It is said that the original title was "A Treatise on Sanity and Longevity," but the bookseller refused to print the book unless the title was changed. It ran through ten editions and was translated into Latin, French and German. To the Latin edition "De Natura Fibræ" was added. This is often considered the best of Cheyne's works. During the writing of it his own health was very bad and perhaps it was natural that he should have announced it as his last work. In the preface he states that he is casting up his accounts with the world and asks pardon for the severity of some of his earlier writings. The book was produced casually. His friend Sir Joseph Jekyll asked for instructions as to the care of his health. Cheyne drew these up as a set of rules, but on consideration thought that philosophical reasons should be added out of respect for his friend's intelligence.

This work, he insists, will not appeal to the young and robust but only to the sickly and aged, the sedentary and members of the learned professions. It is not for the robust, the luxurious, the pot-companions, the loose and abandoned, for "their time is not yet come." The constant theme is that it is easier to preserve than to recover health and to prevent than to cure disease. Over-scrupulous attention to our health is folly; only moderate and proper care is necessary.

He discourses at length on meat and drink. The frequent error of taking too great quantities of food is especially emphasized and instances of long life on little food quoted. For an ordinary man, not a laborer, he suggests eight ounces of meat, twelve of vegetables or bread and a pint of wine a day as sufficient diet. But valetudinary and sedentary persons ought to take even less. Most of the chronic diseases, the infirmities of age and the short lives of Englishmen are due to repletion. The remedy for this is evacuation, purging, bleeding, vomiting and sweating. But he asks, why not omit one meal, leave off meat and liquors and do practically the same thing? As soon as those of sedentary life or professional occupation have any heaviness, inquietudes, restless nights or aversion to occupation, they should lessen their food one-half or go on to vegetable diet. He gives the rule that if one is unfit for duties or studies one hour after a meal, too much has been eaten.

To alcohol much attention is given and more of condemnation than of commendation, although he is careful to point out that he has no intention of trying to "discourage the innocent means of enlivening conversation, promoting friendship, comforting the sorrowful heart and raising the drooping spirits by the cheerful cup and the social repast. Persons sober in the main will receive little prejudice from such a fillip when the occasion happen but seldom."[7] It is the abuse which he combats. Many of his sayings are worthy of quotation, as "strong waters should never be taken but by the direction of a physician or in the agonies of death. For when persons arrive at that stage that they become necessary to their ease and freedom of spirits, they may be justly reckoned among the dead both as to the short time they have to live and the little use they can be either to themselves or mankind." While his remarks as to the use of spirits are severe, it is regarding punch that he grew specially emphatic. He considers it like opium in its nature and nearest arsenic in its deleterious and poisonous qualities. Fielding makes a reference to this in saying that Cheyne termed "drinking punch pouring liquid fire down your throat." Of tea and coffee he considers their virtue to consist in custom and all their harm in excess. "Life is not weak enough to be destroyed by this pop-gun artillery of tea and coffee." In using tobacco he warns against "swallowing the smoke."

Exercise he advises with caution in regard to its being done on an empty stomach, not to fatigue, with care after perspiration and always with moderation. Of cold bathing he speaks with approval. The evacuations are discussed at

[7] We may remember how well this point of view was put by Oliver Wendell Holmes in "The Professor at the Breakfast Table."

length. He devotes some attention to mucous colitis and describes the associated neurotic condition.

It is not strange that the passions should figure prominently. Dark melancholy, slow and long grief, hopeless love and overweening pride—which is self-love—may all wear out the nervous system. "Long and constant habits of fixing one thing on the imagination begets a ready disposition to the nerves to produce again the same image till the thought of it becomes spontaneous and natural and also a disability ensues on the other parts." Of another kind of melancholy he says: "it is called religious, although often the persons so distempered have little *solid piety.* This melancholy arises from a disgust or disrelish of worldly amusements and creature comforts, whereupon the mind turns to religion for consolation and peace. But as the person is in a very imperfect and unmortified state there ensues fluctuation and indocility, scrupulosity, horror and despair."

To the rules of life that the aged should observe he gives much attention. Care in their surroundings, the avoidance of exposure and a steady lessening in their diet are most important. Aged persons become children as regards their digestion and should diminish their diet. He has much to say of chronic diseases. One of his sentences might well be given to many of our patients. "It is surprising that reasonable men can imagine that in any small time any possible methods or medicines should cure or even sensibly relieve a distemper that perhaps was brought with them into the world and interwoven with the principles of their being, or may have been ten or twenty years abreeding." He uses the illustration of the revenues of an estate as comparable to the wasting or undue spending of health and energy. The whole argument may be summed up as the observance of the golden mean

—servare modum, finemque tueri,
Naturamque sequi—

The English Malady.—This was published in 1733 and ran through six editions. Cheyne had written it some time before and intended it to be produced as a dying speech, but his friends persuaded him not to defer its publication so long. The title suggests an immediate question as to the nature of the disease described. Were it written now the name of another nation would probably grace the title-page, for in this "westward the course of empire takes its way." The book treats of functional nervous diseases and might be described as a treatise on hysteria, neurasthenia and hypochondriasis. It is difficult in a short sketch to do justice to any of Cheyne's work, but this is especially true of this one. It aroused much interest then and later. Dr. Johnson often refers to it. M. Grosley, who visited London in 1758 and wrote a work, "Londres," speaks of this book and discusses the theories as to what Cheyne describes. It may be mentioned that he suggested a panacea for these ills in the form of light French wines.

Cheyne well uses the lines beginning "Facilis descensus Averni" as a motto. The title, he explains, is a name given in reproach by foreigners to nervous distempers, spleen, the vapours, etc., which are all too common in England. He opens with a description of the terrors of nervous disorders, which he considers the worst. "Tho' other evils be a burden yet an erected spirit may bear them, but where the supports are fallen and cover the man with their ruins, the desolation is complete." No distinction is made between organic and functional disease. Throughout he dwells on the importance of heredity as a causal factor: "A poor creature born subject to nervous distempers has no more reason to complain than a child whose father has spent his worldly fortune and left him poor and destitute." But even for these he holds out hope, and one of the best lessons he teaches is the importance of such nervous cripples learning how best to live. They must know their limitations: "no art hitherto known can make an eagle of a wren." But he notes, and how truly, that under proper care such people may get more out of life, especially in its intellectual side, than the more robust. He is fond of the idea that people who start with little nervous force, by care and moderation, are likely to be at forty as well off as those who started with more but wasted more: "every wise man has a *youthhood* once in his life—age recompenses the caution, care and sufferings of their younger days."

Then follows his constant view, that the chief cause of men's suffering is what they "swallow down." They may ascribe it to various other causes, but overeating and drinking are the real ones. Luxury and disease advance together.

The second part deals with the treatment of nervous disorders. The methods savor of the time. Calomel and antimony are most necessary. Many drugs are referred to and special praise given to Jesuit's bark. The advantage of combining purgatives with iron is emphasized. Then comes the discussion of diet. The same general rules as laid down in the earlier works are repeated. For the nervous he advises some hobby or amusement. The symptoms of nervous maladies are given at length. They are largely those of hysteria or neurasthenia, but a few of organic disease are included, which relate principally to hemiplegia. Insomnia was evidently as frequent then as now. It would take too long to notice all the sections of this book. One point is of interest; he notes that the nervous patients rarely like to be told the nature of their ailment. Many deny its existence, but "this disease is as much a bodily distemper as the small-pox or a fever." He quotes many illustrative cases. Among these is the celebrated one of Colonel Townshend, who was apparently able to stop the action of his heart for a time. Cheyne notes having seen him do this, and thought the experiment had been carried too far, he was so long in reviving.

The volume ends with the author's account of his own case, a most amazing story, and one which has been largely quoted before. He points many a moral from himself. This work rather differs from his others. There is less of general theory and more of deduction from actual observation. Dr. Johnson wrote to Boswell: "Read Cheyne's English Malady, but do not let him teach you a foolish notion that melancholy is a proof of acuteness." Here he seems to do Cheyne an injustice. Johnson had no evident idea of any distinction between hypochondriasis and what we term neurasthenia. Cheyne evidently saw the distinction, and points out that the neurotic patient, if he lived rationally, despite his infirmity, often got more real pleasure out of life than the more phlegmatic individual. He had periods of misery, but these were more than offset by the keener appreciation of pleasure.

He uses one explanation as to why these disorders were so prevalent. We use it to-day. It is that the conditions of *modern life* are largely responsible and have produced this class of distempers. Doubtless Charon could give some idea of the antiquity of this view.

Essay on Regimen, 1740.—This ran through three editions and was translated into Italian. Cheyne seems to have considered it his best work, but it was not the most popular. Arranged under the heading of discourses it perhaps savored rather of a sermon, and there is much of both mathematics and philosophy mixed through it.

True philosophy he defines as the science of living the most happily through the whole period of our existence. Physick is only a part of it. To excuse his perhaps tedious writings it must be remembered that old men are as children and must have their rattles. He, for his part, prefers to play with ideas and philosophical conjectures than to dwell on the dark side of things that lead to Pyrrhonism, fatalism, infidelity and despair. These doctrines may help others in the middle state between the two worlds.

He begins with a general discourse and asks a question we are busily trying to answer yet. "What is it then that art, physick or a philosophic physician can truly do to relieve the miseries, pains and diseases of our fellow-creatures?" His answer to the question is the book. We may think that perhaps he is hardly correct in holding that diet alone, "proper and specific diet in quantity, quality and order," is the one thing needful to which all the other blessings will then be added. With diet he includes the drinking of water, the sole use of which as a beverage will ensure a happy and long life. But always in diet the quantity is of more consequence than the quality. His general rule for diet is that for those who are sedentary or destined for such a life, from birth to fifteen to use a temperate diet without liquors, from fifteen to fifty to be only temperate in animal foods and fermented liquors, after fifty to give up animal food, suppers and fermented liquors, after sixty to give up all animal food, and then every ten years to lessen about a quarter of the quantity of their food. For those who by heredity are prone to illness these should be still further reduced.

In lowness of spirits there are three remedies short of medical care; first, a vomit; second, exercise, bathing and rubbing, and lastly, the lightest food. To all such, especially if they be thin, he advises an abdominal binder or support. Then are given thirty-seven aphorisms for the valetudinarian, of which two may be quoted.

Aphorism 8.—He that would be soon well must be long sick, that is, treat himself as a valetudinarian in most things.

Aphorism 14.—He that is old when he is young, that is, treats himself as a wise old man does or ought to do, by great temperance, air and exercise, if he lives past thirty-five will be young when he grows old in years.

The second discourse treats of the use of animal and vegetable food. There are many philosophical conjectures of little interest. The origin of evil is discussed, and we are compared to slaves laboring at the oar hoping for deliverance. He wanders off into theological and philosophical matters. Animal food he considers to have been allowed as a punishment to the race. The bodily discomfort following its use will perhaps turn us to better things. Animal food was permitted and fermented liquors not forbidden, therefore there is neither virtue nor vice in the use of them absolutely but only in the manner of their use.

A great part of the work deals with mathematics, philosophy and theology. One is inclined to say that his common sense is better than his theology, yet there is one idea on which he puts special emphasis, namely, that the intellectual and spiritual welfare must depend partly on the bodily state; "a sick and diseased person seldom perceives truly nor reasons justly." The moral qualities must be bound up with the bodily ones. He touches on predestination and foreknowledge, but owns their difficulties of explanation.

The Natural Method of Cureing the Diseases of the Body and the Disorders of the Mind Depending on the Body.—This was his last work, published in 1742, the year before his death. It was dedicated to the Earl of Chesterfield, who in writing to Cheyne in acknowledgment speaks of his own bad health and refers to his intention of taking the waters again, saying: "I find my shattered tenement admits of but half repairs and requires them annually. The *corpus sanum* which you wish me will never be my lot, but the *mens sana* I hope will be continued to me, and then I shall better bear the infirmities of the body." This book went through five editions and was translated into French. It consists of three parts, the first treating of the economy of nature in animal life. This is largely philosophical and of no special interest. The second part treats of the means and methods for preserving life, health and serenity. Health, cheerfulness and activity all consist in the proper performance of certain bodily functions. The "too much" or the "too high" in food interfere with these. Alcohol is condemned throughout. An overdose of it may make a man as mad for a time as any one in Bedlam, and in the same way a surfeit of strong, high food will "sink, depress and disable" a man as much from all rational thinking and action as habitual melancholy and hypochondriasm.

The third part discusses the nature and cure of chronic disorders. Many diseases are discussed. He has an interesting word on the use of water in dropsy. "It is a vulgar error that water drinking is of dangerous consequence in this case; nothing is more false. And I have known many a dropsy in free drinkers prevented by drinking nothing but water, as it alone infallibly cures an anasarca at last if early begun." Of the outlook in ascites he takes a gloomy view. "A true formed ascites is no more to be cured than a confirmed phthisis from putrifyed lungs or tubercles. All that can be expected is a mere palliative cure. All violent remedies, as strong vomits, purges and diuretics, are precipitating fate only at the expense of a little present relief."

There are many directions as to care in diet, and he answers objections to his views. As one of his final admonitions he says, "If a man after forty, though in perfect good health, begins not to study regimen and manage his diet at least in quantity, I conclude him neither physician nor philosopher." He brings out the argument that care in living is surely worthy of practice if only to attain happiness and serenity for the seventy or eighty years of this life, but if we contemplate a future existence "is it not madness to deviate from a path which leads to a happy Eternity!" And among the things to be striven for are "above all a clear conscience, beneficent temper, peaceful resignation and well-grounded hope which

'Summum nec metuat diem, nec optet.'"

Throughout his writings we have a curious mixture of speculation and sound observation. The profession slowly learned that the theory of tradition was not necessarily right, and that correct deduction from accurate observation was more important. The gradual appreciation of this can be read in Cheyne's writings. As he observed more he trusted more to his own experience. As the Earl of Chesterfield said in writing to Cheyne of one of his books, "The metaphysics may be true, but they are guesswork, while the part founded on knowledge and experience is a work of public utility."

His style is vigorous and has the characteristics of the time. He has the art of putting things forcibly, but not the power to keep out much which seems unnecessary. Everywhere common sense predominates and there are few essential points regarding diet to be added. Temperance is his theme throughout. The gospel of work is also preached; "no voluptuous or lazy person, unless he had an original constitution of brass, was ever a long liver."

The change in his writings is evident. We have seen the too bitter animosity of his pen in the early controversies of his career. As life goes on he mellows, regret is expressed for his harsh words and pardon asked for them. Some extracts from his last work, produced shortly before his death, will show the spirit in which he writes. Speaking of his hopes and aims to help others, he says: "I may have deceived myself, but if I know my own heart have not a single temptation to deceive others. My age is little short of seventy years, at which time in life a thought of adding to my reputation or to my purse would be extreme folly. The first is now at the disposal of the public, the latter will soon be in the hands of my executors.. But though I should convince the world I must not expect to convert it. . . . As the time is hourly stealing on when art can do no more, an observance of these rules will be the calmest and easiest way of laying down in death."

III. APHORISMS AND SAYINGS.

Many of these have been quoted before, but some others may be added. They can hardly be put in a connected form.

> "This universal infirmary, Bath."
>
> "He that would have a clear head must have a clean stomach."
>
> "He that despiseth little things (in health) must perish by little and little."
>
> "Too great nicety and exactness about every minute circumstance that may impair one's health is to die for fear of dying."
>
> "It seldom comes to pass that any one is much troubled with the Gout but he has the stone at last."

Of alcohol he has little good to say. He did not deny its place and use, as some previous quotations show, but in general he has only condemnation for it.

> "Fermented or distilled spirits are the true Pandora's' box."
>
> "More than very small amounts of spirits come of sin and must be diluted with the waters of repentance.'"
>
> "Spirits have made more havoc among nations by far than gunpowder. But always the least is the best of all fermented liquors whatsoever."

In reference to the relation of physician and patient he has many good sayings.

> "Fine folks use their physicians as they do their laundresses, send their linen to them to be cleaned in order only to be dirtied again."
>
> "It is become the reproach of physick and physicians that acute cases cure themselves (or rather nature cures them) and chronical cases are never cured. But both branches of the reflexion are equally false." Of chronic cases he says:
>
> "If due care be had to follow timeously the advice of an honest and experienced physician, a period certainly may be brought about to most chronical disorders, where the great viscera are not spoiled and destroyed. The failing is in the patient himself, who will not or cannot deny himself for a time sufficient to bring about a cure."
>
> "London houses are made to last fifty years, country houses for five hundred. With some the common way of dealing with their patients is constantly to blow the fire, as with a pair of smith's bellows, till they blow it out or in a few blasts consume it to ashes. The method I would insinuate is to take out the ashes and dead coals, keep it open and give it air, and then it will burn as long as the nature of the materials will allow. One long-lived glutton or drunkard kills more by his example than Hippocrates ever saved." [8]

His formal aphorisms were thirty-seven in number. An example of them may be given:

> 13. Every wise man after fifty ought to begin to loosen at least the quantity of his aliment, abating gradually and sensibly, and at last descend out of life as he ascended into it, even into the child's diet.
>
> 32. Fifty was designed as the meridian of life in this our lapsed state and duration on this ruinous planet; from this soltitial point it is a descent out of life. The hyperbolic curve of life is at the point of its return downwards again, and if care be taken to put

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[8] We have the same idea in our saying of to-day that "It is the clinkers that kill." One wonders how Cheyne would have regarded the statement of Panurge that there are more old drunkards than old physicians.

a drag on the wheels of life they may go down gently, calmly, and serenely.

35. Nature dissolves the body gradually "till like a dying vegetable she has fitted it in the earth from whence it sprung."

I hope you feel with me that in George Cheyne we have a man well worthy of being kept in remembrance both for his work and for himself. He preached temperance to an intemperate generation and—as he himself says—such a one is never popular. He doubtless rode his hobby too hard and too far, but was always on the better side of the error. The literature of his day and the many references to his views show how much influence he had. That he should have dabbled in philosophy and theology, speculating on the origin of evil, dwelling on predestination and like difficult matters, is perhaps not strange when we remember his nationality and training. Always "dying for fear of dying," a lifelong valetudinarian, he gives us an essay on health and long life; racked by the gout, he writes a treatise on it with advice to his friend and philosophical reasons therefor; neurotic and a prey to every "hypish" imagination, he produces "The English Malady." Truly to him might the words of Socrates be applied, "Now the most skillful physicians are those who from their youth upward have combined with the knowledge of their art the greatest experience of disease; they had better not be robust in health and should have had all manners of diseases in their own persons." Plato, Republic, 3, 408.

The study of his works gives one the impression of a likeable man. One feels that he was sincere in his endeavor to help those afflicted like himself—a Falstaff, if you will, but without his vices and with more than his virtues. I have already compared him to Johnson, one more of whose allusions to Cheyne may be quoted: "'All is best,' says Cheyne, 'as it has been except the errours of our own free will.' Burton concludes his long book upon melancholy with this important precept: 'Be not solitary; be not idle.' Remember Cheyne's position and observe Burton's precept."

In conclusion I cannot do better than quote some of Cheyne's own words: "To bear and forbear is all that is absolutely necessary in this life to make a man tolerably easy, and his pain and suffering cannot have risen to any great height who will not submit to this."

A CASE OF AMAUROTIC FAMILY IDIOCY.

By Ernest Sachs.

(From the Neurological Clinic, The Johns Hopkins Hospital Dispensary.)

The case reported here is of interest as being the first example of this disease observed at the Johns Hopkins Hospital, and though it was impossible to obtain an autopsy, it is, nevertheless deemed worth while to put it on record as another example of a rather rare condition. I am indebted to Dr. Thomas both for the privilege of following the case as well as of reporting it.

D. K.—Nerv. Dis. No. 14634, age 14 months, was first seen at the neurological dispensary of the hospital on June 6, 1903. The diagnosis was at once apparent from the general condition and the typical retinal picture.

F. H.—Father and mother both healthy and well; not related to one another. They are Russian Jews. No history of syphilis in either parent. This is the third child. The oldest, 5 years, a boy, is healthy and has never shown any symptoms of a similar trouble. The second child when several years old died of diphtheria. There is no history of a similar disease in either the father's or mother's family.

P. H.—This patient was a full term child, the labor was normal and the child seemed perfectly healthy. No history of convulsions or any symptoms pointing to hereditary syphilis. When six weeks old the child had bronchitis; has had some cough at intervals ever since. When 1 year old had measles and from this time mother dates the illness. Child was breast fed, the feeding being supplemented with cow's milk of excellent quality. Child has never spoken or crawled. The bowels have always been constipated and are moved with considerable difficulty.

P. E.—Patient is a weak, sickly looking child. Its face is expressionless, but at times seems to smile. Cannot hold its head up, it falls back or forward. Pupils are equal and moderately dilated, and react to light. Child takes notice of objects and follows them about, but does not seem to see so well at the periphery. Child seems to hear. Starts violently at a sudden sound. Every now and then has a spasmodic jerk of its muscles. Some stiffness of arms on passive motion; no contractures. At a sudden sound legs and arms are stiffened.

Reflexes.—Deep reflexes much exaggerated in arms and legs. Jaw jerk is active, and associated with this is a contraction of the orbicularis. No ankle clonus but an active tendo Achillis reflex. Flexor response of all the toes on plantar stimulation. No local atrophy; no paralysis of any muscles. Sensation seems to be present everywhere. The prick of a pin is responded to at times by a jerking all over the body. The ophthalmoscopic examination revealed the characteristic picture of this disease. The patient was referred to the eye department where Dr. Randolph made the following note: "Around the fovea in both eyes there is a cherry red spot, surrounded by a gray area. The optic discs look a little pale."

From this time on the patient, although watched carefully and seen repeatedly, grew progressively weaker. In October the following note was made: "Child is getting weaker; no longer can hold anything in its hands. Has been weaned.

Symptoms remain as previously described." About this time the child developed difficulty in deglutition and could not swallow its food. This symptom continued and became more marked. Vision seemed completely gone, and the patient no longer responded to a bright light or speech, but starts at a loud sound. The patient continued to get weaker. Rigidity of arms and legs became very much more marked. Slight contractures appeared in the legs. On several occasions the child had attacks of explosive laughter which seemed to come without any apparent outside stimulus.

The child grew continually weaker, lost weight and became very much emaciated, presenting a typical picture of marasmus, and died February 29, 1904.

Remarks.—This case is undoubtedly an example of the spastic form of amaurotic family idiocy. It shows all the cardinal symptoms of the condition as well as two features which have only been observed in a few instances by Falkenhein, namely, the explosive laughter and disturbances in deglutition.

The most recent views about this disease with a fairly complete bibliography may be found in the Journal of Nervous and Mental Disease, January, 1903.

SUMMARIES OR TITLES OF PAPERS BY MEMBERS OF THE HOSPITAL OR MEDICAL SCHOOL STAFF APPEARING ELSEWHERE THAN IN THE BULLETIN.

John J. Abel, M. D. The Function of the Suprarenal Glands and the Chemical Nature of their So-Called Active Principle.—*Contributions to Medical Research,* Dedicated to Victor C. Vaughan, Ann Arbor, 1903.

Samuel Amberg, M. D. Sublingual Growth in Infants.—*American Journal of the Medical Sciences,* August, 1903.

Charles Russell Bardeen, M. D. Variations in the Internal Architecture of the M. Obliquus Abdominis Externus in Certain Mammals.—*Anatomischer Anzeiger,* June 24, 1903.

John S. Billings, Jr., M. D. The Work Performed by the Diagnosis Laboratory of the Department of Health in Connection with Ehrlich's Diazo Reaction during 1902. —*New York Medical Journal,* April 18, 1903.

——— The Value of Confirmatory Cultures in Diphtheria. —*New York Medical Journal,* September 12, 1903.

——— The Administration of Antitoxine in Diphtheria by the Department of Health During 1902.—*New York and Philadelphia Medical Journal,* December 12, 1903.

E. Bates Block, M. D. Parotitis Following Typhoid Fever. —*Atlanta Journal Record of Medicine,* February, 1903.

Male, age 34 years, developed parotitis of the left side on the 47th day of the disease, 16 days after his temperature reached normal. The involvement of the parotid gland was followed by a rise of temperature to 101.3° F. and ran an irregular course for five days. There was no evidence of suppuration.

The original paper mentions the various inflammatory lesions produced by the typhoid bacillus, and the occurrence of parotitis following other diseases of the abdominal, or pelvic, viscera, or generative organs.

——— The Relation of the Nervous System to Unilateral Sweating.—*Transactions of the Medical Association of Georgia,* 1903, page 291.

A Russian tailor, aged 47 years, was admitted to Dr. Thomas' Clinic in the Johns Hopkins Hospital Dispensary on the 23rd of April, 1901, complaining of excessive paroxysmal sweating on the right side of the head and body which had existed for twelve years and was most marked on the right half of the face, head and shoulder and the upper part of the chest, and limited sharply by the mid-line. The right ear and the left side of the face and body did not sweat during the paroxysms. The mouth was drawn a little upward at the right corner which extended further lateral than to the left, the right labio-nasal groove being much deeper and more distinct than the left. During the paroxysms, the right side of the face becomes redder than the left. The right fore-arm and hand sweat more than the left. After cleaning the face with neutral alcohol, the sweat was always found to be slightly acid and contained sodium chloride. Sensation was normal for all varieties. Many experiments were tried, to observe the effect on the sweating. Drinking hot water caused most profuse perspiration, the sweat pouring in streams down the right side of his face. The right side of the face became warmer and redder than the left during the sweating attacks, and the axillary temperature ranged from 0.1° F. to 0.5° F. higher in the right axilla than the left. In thirteen observations on the pupils, both during the sweating attacks, and between them, the right pupil was slightly smaller than the left ten times, while on three occasions both pupils appeared equal. The pupillary reactions were all retained. There was myopia of both eyes, greater in the right. After pilocarpine injections, the sweating began first, and was more pronounced, on the right side.

After a general discussion of the literature, a case of peripheral nerve paralysis was reported, which seemed to indicate that a complete nerve paralysis was accompanied by anidrosis, while a partial paralysis was accompanied by hyperidrosis, while on a return of the nerves to normal function, the sweat secretion also became normal.

Statistics were collected from 107 cases, and the syndrome of myosis, redness, increased temperature, and unilateral sweating on the same side was present in such a large majority of cases that they must at least be regarded as the rule.

The temperature on the sweating side in thirty-two cases, was increased in twenty-seven, equal in four, decreased in one. (In the case reported above, the right axillary temperature was 0.2° F. lower than the left between the sweating attacks).

Redness was present in twenty-nine cases, and not present in three cases, out of thirty-two cases in which a note was made on this point.

Myosis has not proven such a constant concomitant. Thus in forty-seven cases, the pupils were larger on the sweating side in nine, smaller in twenty-three, equal in fifteen, but it is very probable that a slight difference in the size of the pupils in the last group was unnoticed in some cases. Moreover, many of these cases in which the pupils were equal or larger, were evidently not cases of sympathetic affection, so that the occurrence of myosis has really a greater relative frequency than appears in this table.

In regards to sex, there were fifty-seven males to twenty-five females affected with unilateral sweating.

Forty-four cases occurred on the right side, and thirty-three on the left.

In eighteen cases some affection of the parotid gland was noted. Further statistics may be seen in the original article.

JOSEPH C. BLOODGOOD, M. D. Rare Case of Appendicular Abscess Situated between the Layers of the Mesentery of the Small Intestine.—*American Journal of the Medical Sciences,* October, 1903.

——— Intestinal Obstruction Following Operation for Reducible Left Inguinal Hernia Due to a Loop of Small Intestine caught in Freitz's Fossa.—*Annals of Surgery,* December, 1903.

GEORGE BLUMER, M. D. A Note on the Embryonal Glandular Tumors of the Kidney.—*Albany Medical Annals,* August, 1903.

——— and H. C. GORDINIER, M. D. A Case of Chronic Lymphatic Leukaemia without Enlargement of the Lymph Nodes.—*Medical News,* October 31, 1903.

JOHN BRADFORD BRIGGS, M. D. A Note on the Association of a Rise in Systolic Blood Pressure, with the Onset of a Perforative Peritonitis in Typhoid Fever.—*Boston Medical and Surgical Journal,* September 24, 1903.

THOMAS R. BROWN, M. D. The Blood in Health and Disease with a Review of the Recent Important Work on this Subject. *The International Clinics,* Vol. 4, 12th Series.

——— Enteroptosis, its Etiology, Symptomatology, Treatment, and Prognosis.—*American Medicine,* Vol. 6, August 15, 22, 29, 1903.

——— The Diuretic Value of Salt Solution Enemata, Especially After Renal Operations.—*Maryland Medical Journal,* August, 1903.

——— The Value of Leucocyte Counting in Differentiating Post-Operative Auto-Intoxication from Peritonitis.—*Maryland Medical Journal,* August, 1903.

——— The Gastric Contents in Gastroptosis.—*New York and Philadelphia Medical Journal,* September 26, 1903.

——— The Value of Albuminuria in Differentiating Pyelitis from Cystitis.—*New York and Philadelphia Medical Journal,* October 17, 1903.

——— Urinary Hyperacidity.—*New York and Philadelphia Medical Journal,* November 14, 1903.

C. H. BUNTING, M. D. The Effects of Lymphotoxins and Myelotoxins on the Leucocytes of the Blood and on the Blood-forming Organs.—*University of Pennsylvania Medical Bulletin,* July-August, 1903.

——— Primary Sarcoma of the Spleen with Metastases. Report of a Case.—*University of Pennsylvania Medical Bulletin,* July-August, 1903.

W. J. CALVERT, M. D. Plague Serum in Three Cases.—*Boston Medical and Surgical Journal,* January 8, 1903.

——— Transmissibility of Plague.—*American Medicine,* January 24, 1903.

——— Plague Bacilli in the Blood.—*Centralblatt f. Bakteriologie, Parasitenkunde u. Infectionskrankheiten,* 1 abt., XXXIII Bd., No. 4. 1903.

——— Comment on Plagué Memorandum.—*American Medicine,* March 7, 1903.

——— Tropical Diseases: General Introduction.—*Buck's Reference Handbook of the Medical Sciences,* Vol. VII, 1903.

——— Record of Parasitic Infections in the Philippines.—*Boston Medical and Surgical Journal,* October 23, 1903.

C. N. B. CAMAC, M. D. A Preliminary Report of the Venous Hum in Relation to the State of the Blood.—*Medical News,* March 21, 1903.

Demonstrated from cases that the venous hum may be and frequently is present with normal blood.

——— Some Observations on Aneurism and Arteriosclerosis.—*The Mütter Lecture,* delivered December 1, 1903, at the College of Physicians, Philadelphia.

A historic review of the development of our knowledge of vascular diseases and pathological and historical consideration of the initial changes in the vessel wall in arteriosclerosis and aneurism.

JOHN G. CLARK, M. D. Address in Obstetrics, delivered before the Meeting of the Medical Society of the State of Pennsylvania, York, September 22, 1903. I. The Treatment of Cancer of the Uterus by Roentgen Rays. II. The Etiology of Eclampsia.—*University of Pennsylvania Medical Bulletin,* November, 1903.

——— Lessons from the Life of Pasteur.—*Northwest Medicine,* Vol. I, No. 6, 1903.

——— Histogenesis of Glandular Cysts of the Ovary.—*Transactions of the American Gynecological Society,* 1903.

Henry W. Cook, M. D. The Accurate Estimation of Pulse Tension.—*The Old Dominion Journal of Medicine and Surgery,* October, 1903.—*Virginia Medical Semi-Monthly,* November 13, 1903.

Thomas S. Cullen, M. B. Uterine Myomata and their Treatment.—*Canada Lancet,* July, 1903.

——— Sarcomatous Transformation of Myomata.—*Journal of the American Medical Association,* October 24, 1903.

——— Adeno-Myome des Uterus. Berlin, 1903.

George W. Dobbin, M. D. Management of Normal Labor. —*Buck's Reference Handbook of the Medical Sciences,* 1903.

Arthur W. Elting, M. D. The Unusual Symptoms of the Weakened Foot, with Illustrative Cases.—*Albany Medical Annals,* April, 1903.

John M. T. Finney, M. D., and Omar B. Pancoast, M. D. Enterostomy, with Report of Cases.—*American Medicine,* August 22, 1903.

The paper calls attention to certain additional indications for the performance of the operation of enterostomy:

1. To drain temporarily a distended intestine, thus allowing it to regain its normal tome.
2. To enable one to nourish a patient whose stomach and rectum are unable to retain or absorb a sufficient amount of nourishment.

After calling attention to several general considerations which had been noticed in the author's experience, seven cases of enterostomy were reported for various causes.

Simon Flexner, M. D. A Note on Autolysis in Lobar and Unresolved Pneumonia.—*University of Pennsylvania Medical Bulletin,* July-August, 1903.

——— An Aspect of Modern Pathology.—*American Journal of the Medical Sciences,* August, 1903.

——— and Hideyo Noguchi, M. D. On the Plurality of Cytolysins in Snake Venom.—*University of Pennsylvania Medical Bulletin,* July-August, 1903.

W. W. Ford, M. D. Classification and Distribution of the Intestinal Bacteria in Man.—*Studies from the Royal Victoria Hospital,* Vol. I, No. 5, May, 1903.

T. B. Futcher, M. B. The Occurrence of Gout in the United States.—*The Practitioner,* July, 1903, p. 6.

1. The apparent infrequency of gout in the United States is due in large part to failure to recognize the disease.
2. Out of 15,697 medical cases admitted to Dr. Osler's wards at the Johns Hopkins Hospital during a period of 14 years, there were 41 cases of gout, or 0.26 per cent of the total number of medical patients. For the same number of years at Saint Bartholomew's Hospital there were 124 cases out of a total of 33,356 medical admissions, or 0.37 per cent of the medical cases.
3. The ratio of admissions of gout to the two hospitals is respectively a little greater than as 2 is to 3; or, in other words, the admissions of gout to a general hospital are a little less than one-third more frequent in London than in Baltimore.
4. All of the 42 cases were males. There was only one colored patient in the series. The negro race appears to possess a relative immunity from the disease. The largest number of cases, 13, occurred in the fifth decade. Of special interest is the fact that 32 of the patients were native-born Americans.
5. The majority of the cases appear to have earned rather than inherited their gout. Alcohol and lead seemed to be the most potent aetiological factors.
6. Thirty-nine of the 42 cases had reached the chronic stage before they came under observation. In 19 of the cases tophi were present.
7. Among the most interesting complications may be mentioned four cases of gouty bursitis; one case of parotitis, one of pericarditis, one of retrocedent gout with symptoms simulating intestinal obstruction.
8. There was evidence of disease of the kidneys in the majority of cases. Albuminuria occurred in 32 and hyaline or granular casts in 26 instances.
9. Arterio-sclerosis of varying degree was present in 29 cases and a mitral systolic murmur in 8.
10. The difficulty of differentiating the disease from rheumatism was illustrated by the fact that four of the cases were repeatedly diagnosed as the latter on their early admissions to the hospital, the appearance of tophi later revealing the true nature of the disease
11. The series illustrates the great importance of examining the ears and the vicinity of the joints for the presence of tophi in all cases of multiple arthritis of doubtful origin.

——— Some Points on Metabolism in Gout: With Special Reference to the Relationship between the Uric-Acid and the Phosphoric-Acid Elimination in the Intervals and During Acute Attacks.—*The Practitioner,* August, 1903, p. 181.

The analyses in the cases reported above suggest very strongly a close parallel relationship between the uric-acid and phosphoric-acid excretion in gout. They further point in favor of the view that both are products of nuclein-disintegration. In the quiescent intervals both phosphoric acid and uric acid are markedly reduced below normal. Two or three days after the acute arthritic symptoms commence the phosphoric acid and uric acid gradually increase until they reach the average output, or even the upper limit for normal. As the acute manifestations subside both steadily fall and remain below the lower limit for normal until the onset of the next acute attack.

——— A Study of the Cases of Amoebic Dysentery Occurring at the Johns Hopkins Hospital.—*The Journal of the American Medical Association,* August 22, 1903, p. 480.

In nearly fourteen years 120 cases of amoebic infection have been admitted to the Johns Hopkins Hospital. Of these, 119 were cases of amoebic dysentery and amoebic abscess of the liver, the remaining case being one of amoebic abscess of the floor of the mouth. Of the 120 cases 118 were admitted to the medical wards. During this time there were 15,817 medical admissions, the amoebic dysentery cases constituting 0.74 per cent of the cases. Of the 119 cases of dysentery, 82 were apparently contracted in Baltimore and 13 in the State of Maryland outside Baltimore, or a total of 95 cases within the borders of Maryland. The largest number of cases occurred in the third decade. The youngest patient was a child two years and eight months old, and the oldest a man of 71. A point of special interest is the comparatively large number of cases in children under 10 years. Eleven cases, or 9.4 per cent, occurred in the first decade, 6 of these belonging in the first hemi-decade. There were 108 males and 11 females. The series comprised 107 whites and 12 blacks, or a proportion of 9 to 1. The total ratio of whites to blacks in the hospital is about 7 to 1. A secondary anaemia of moderate grade occurs. Occasionally there is a polycythemia. The average leucocyte count in the uncomplicated dysentery cases was 10,600. In the hepatic abscess cases it was 18,350. Hepatic abscess occurred in 27, or 22.6 per cent, of the cases. Nine of these ruptured into the right lung and 2 into the right pleura. Three opened into the inferior vena cava. In 10 cases of the 18 abscess cases that came to autopsy there was a single large abscess in the upper part of the right lobe. In 8 cases there were multiple abscesses. Perforation of the colon with peritonitis occurred in 3 cases, and severe intestinal hemorrhage in 3 cases. Five cases were complicated by malaria; 1 by typhoid; 1 by pulmonary tuberculosis; and 1 by a strongyloides intestinalis infection. The agglutinative blood reaction with Bacillus dysenteriae was negative in all cases tried. A marked feature of the disease is the great tendency to relapse. The mortality was high; 28, or 23.5 per cent, terminated fatally. Hepatic abscess is a serious complication, 19 of the 27 cases terminating fatally. Five were cured out of 17 operated on. Two of the hepato-pulmonary abscess cases were discharged very much improved. One abscess case did not remain to be treated. Quinine irrigations still seem to give the best results in the treatment of the dysentery.

T. Caspar Gilchrist, M. D., and W. Royal Stokes, M. D. The Presence of Peculiar Calcified Bodies in Lupus-like Tissue.—*Journal of Cutaneous Diseases,* October, 1903.

Henry Harris, M. D. A Case of Progressive Muscular Atrophy of Spinal Origin.—*California State Journal of Medicine,* January, 1903.

Importance of cold and fatigue shown ætiologically in a case resulting two weeks after excessive cold and fatigue while the patient was traveling in Alaska.

William H. Howell, Ph. D., M. D. Obervations upon the Cause of Shock, and the Effect upon it of Injections of Solutions of Sodium Carbonate.—*Contributions to Medical Research,* Dedicated to Victor C. Vaughan, Ann Arbor, 1903.

Guy L. Hunner, M. D. An Interesting Complication in the Diagnosis of Gallstone.—*American Medicine,* May 2, 1903.

Two cases are reported, in one of which was made a possible, and in the other a positive diagnosis of gallstone. Operation in each case demonstrated that the symptoms were due to the omentum being adherent to a former operation wound. The symptoms were probably caused by traction on the parietal peritoneum at the base of the mesocolon.

——— One Hundred Consecutive Cases of Myoma of the Uterus.—*American Medicine,* July 11, 1903.

The writer reports one hundred consecutive cases of myoma of the uterus occurring in the gynecological service at the Johns Hopkins Hospital.

Eighty per cent of these patients were between 30 and 49 years of age. Eighty per cent were married and 32 per cent of these had never been pregnant. Of the 54 women who had been pregnant, 11 or about 20 per cent had borne but one child, and 6 had never carried a child to viable age. One patient had miscarried six times, the fetus never going beyond the fifty month. Of the 54 women who had been pregnant, 20 had miscarried at some period in life.

At times the diagnosis between fibroid tumor and pregnancy can not be made even when the patient is fully anesthetized.

Of the chief symptoms noted, 35 patients complained of an abdominal tumor. Pain, either in the abdomen or pelvis, or in the form of dysmenorrhoea, was complained of by 53 patients. Increased menstrual flow was noted in 41 cases and copious hemorrhages at or between the menstrual periods in 15 cases, making 56 per cent in which myoma was associated with unusual loss of blood.

Gastric symptoms were prominent in 6 cases. Sixteen patients complained of bowel symptoms, and 28 patients of bladder symptoms.

Carcinoma of the fundus occurred in 3 cases, of the cervix in 2 cases. Sarcoma was present in 2 cases. Adenomyoma existed in 2 cases.

The following operations were done for the 100 cases: Myomectomy, 19; panhysteromyomectomy, 14; supravaginal hysterosalpingooophoromyomectomy, 40; supravaginal hysteromyomectomy, leaving one or both ovaries, 16; vaginal myomectomy, 5; vaginal hysteromyomectomy, 6.

Six patients died. In five of them the tumor was complicated by serious pelvic inflammatory disease. One died on the sixth day from septicemia, one on the third day from general peritonitis, one on the fourth day from thrombosis of the left common iliac vein with embolus carried to the pulmonary artery, one suffered with an infected tumor and died in 10 hours from shock, which was profound even before operation. Two died in 20 hours and 4 hours, respectively, from shock due to loss of blood at operation.

——— Tuberculosis of the Urinary System in Women. Report of Thirty-Five Cases.—*Charlotte Medical Journal,* November, 1903.

Henry M. Hurd, M. D. The Duty and Responsibility of the University in Medical Education.—*Science,* July 17, 1903.—*Yale Medical Journal,* July, 1903.

Henry Barton Jacobs, M. D. Maryland's Need of a Mountain Sanatorium for Indigent Consumptives.—*Maryland Medical Journal,* October, 1903.

Howard A. Kelly, M. D. The Early History of Appendicitis in Great Britain. Glasgow Medical Journal, August, 1903.

——— On the Labia Urethrae and Skene's Glands.—*American Medicine,* September 12 and 19, 1903.

——— The Selection of Methods in Abdominal Hysterectomy.—*Journal of Obstetrics and Gynæcology of the British Empire,* 1903, Vol. IV.

J. H. M. Knox Jr., M. D. A Contribution to the Study of the Summer Diarrhœas of Infancy.—*Journal of the American Medical Association,* July 18, 1903.

W. Harmon Lewis, M. D. Wandering Pigmented Cells Arising from the Epithelium of the Optic Cup, with Observations on the Origin of the M. Sphincter Pupillæ in the Chick.—*American Journal of Anatomy,* Vol. II, No. 3.

Irving P. Lyon, M. D. Arterio-sclerosis and the Kidney.—*Transactions of the Medical Society of the State of New York,* 1903, p. 96, and reprinted in *Albany Medical Annals,* March, 1903.

——— Blood Examination in General Practice.—*Transactions of the Medical Society of the State of New York,* 1903, p. 131, and reprinted in *Buffalo Medical Journal,* June, 1903.

——— A Statistical Study of a Rural Cancer District in the State of New York—Brookfield. Fourth Annual Report of the Work of the Cancer Laboratory of the New York State Board of Health, for the year 1902-3, Albany, 1903, pp. 97-119.

——— A Cancer District in the Towns of Plainfield and Edmeston, New York. Fourth Annual Report of the Work of the Cancer Laboratory of the New York State Board of Health, for the year 1902-3, Albany, 1903, pp. 120-123.

——— A Review of Echinococcus Disease in North America.—*American Journal of the Medical Sciences,* January, 1902.

This paper analyzes 241 American cases, citing the original report of each case, where published, and adding many unpublished cases. The cases are considered under the following headings: Age; Sex; Nationality; Geographical Distribution, by States and Provinces; Anatomical Location, by Organs Involved; Diagnosis; Is the Disease on the Increase in America? ; The Distribution of the Disease in Animals in America; The Occurrence in Dogs of the Adult Tapeworm, Taenia Echinococcus; Prophylaxis; Commercial Considerations.

W. G. MacCallum, M. D. On the Production of Specific Cytolytic Sera for Thyroid and Parathyroid, with Observations on the Physiology and Pathology of the Parathyroid Gland, Especially in its Relation to Exophthalmic Goitre.—*Medical News,* October 31, 1903.

Thomas McCrae, M. D. Acute Articular Rheumatism. A Report of the Cases in the Johns Hopkins Hospital, 1902-1903.—*American Medicine,* August 8, 1903.

J. D. Madison, M. D. A Case of Brain Tumor in a Woman Seventy-Eight Years of Age.—*American Journal of Insanity,* January, 1903.

F. P. Mall, M. D. On the Circulation through the Pulp of the Dog's Spleen.—*American Journal of Anatomy,* Vol. II, No. 3.

——— On the Transitory or Artificial Fissures of the Human Cerebrum.—*American Journal of Anatomy,* Vol. II, No. 3.

——— Spleen.—*Buck's Reference Handbook of the Medical Sciences,* 1903.

——— Second Contribution to the Study of the Pathology of Early Human Embryos.—*Contributions to Medical Research,* Dedicated to Victor C. Vaughan, Ann Arbor, 1903.

Harry T. Marshall, M. D. Osteoma.—*Buck's Reference Handbook of the Medical Sciences,* 1903.

——— Side Chain Theory of Paul Ehrlich.—*Buck's Reference Handbook of the Medical Sciences,* 1903.

G. Brown Miller, M. D. Congenital Dilatation of the Gall Bladder and Bile Ducts.—*The American Journal of Obstetrics,* Vol. XLVIII, No. 2, 1903.

The patient, a girl 2½ years old, was born with a very large abdomen, which measured a few days after birth 24½ inches in circumference. She was well developed, learned to walk about the usual age, and except some trouble with digestion and inconvenience due to the size of the abdomen, was apparently in good general health. Her stools varied from clay color to a light brown. The size of the abdomen was due to a tumor, which proved to be an enormous dilatation of the gall bladder and bile ducts, and occupied most of the abdominal cavity. Three litres of thin bile containing mucus were evacuated after stitching the tumor to the abdominal wall. No gall stones could be found. The bile continued to flow through the fistula and the stools showed an absence of bile for three months, when after a great outflow of thick bile-stained mucus the fistula closed and the stools assumed a normal color. She is now quite well, 1½ years after the operation.

The liver was represented by a very small left lobe and a mass of liver substance the area of the palm of the hand and about 1-2 cm. thick, lying intimately adherent to the cyst and separated from the left lobe by an interval of 5 cms. The ligaments of the liver were attached to the cyst.

G. H. F. Nuttall, M. D. In Memoriam: Walter Reed.—*Journal of Hygiene,* Vol. 3, pp. 292-296.

——— In Memoriam: Edmond Nocard.—*Journal of Hygiene,* Vol. 3, pp. 517-522.

——— and A. E. Shipley, M. A. Studies in Relation to Malaria. II. (Concluded). The Structure and Biology of Anopheles.—*Journal of Hygiene,* Vol. 3, pp. 166-215.

E. L. Opie, M. D. Disease of the Pancreas; Its Cause and Nature.—*J. B. Lippincott Company,* Philadelphia and London, 1903.

——— Protozoa-like Bodies of Carcinoma, Smallpox and Leukæmia.—*Twentieth Century Practice of Medicine,* Vol. XXI, p. 553.

——— Plasmodium Malariae.—*Buck's Reference Handbook of the Medical Sciences,* 1903.

——— Symptoms and Treatment of Pancreatic Disease.—*International Clinics,* 1903.

William Osler, M. D. Chronic Cyanosis, with Polycythæmia and Enlarged Spleen: A New Clinical Entity.—*American Journal of the Medical Sciences,* August, 1903.

——— On the So-Called Stokes-Adams Disease (Slow Pulse with Syncopal Attacks, etc.).—*The Lancet,* August 22, 1903.

——— The Home in Its Relation to the Tuberculosis Problem.—*Medical News,* December 12, 1903.

——— Typhoid Fever and Tuberculosis.—*American Medicine,* December 26, 1903.

Mary S. Packard, M. D. An Encapsulated Diplococcus in Mastoiditis.—*Journal of Medical Research,* March, 1903.

Otto G. Ramsay, M. D. A Discussion of the Etiology and Modern Treatment of Eclampsia.—*Yale Medical Journal,* September, 1903.

Robert L. Randolph, M. D. The Bacteria Concerned in the Production of Eye Inflammations.—*Journal of the American Medical Association,* October 3, 1903.

Hunter Robb, M. D. The Mortality following Operations for Pus in the Pelvis.—*Journal of the American Medical Association,* January, 1903.

——— The Vaginal Incision in Sepsis following Abortion.—*American Gynecology,* June, 1903.

——— Ovariotomy.—*Buck's Reference Handbook of the Medical Sciences,* June, 1903.

Benjamin R. Schenck, M. D. Results in a Series of Forty-eight Kidney Fixations.—*Detroit Medical Journal,* December, 1903.

——— Some Essential Points in the Use of the Kelly Female Cystoscope.—*Journal of the Michigan State Medical Society,* December, 1903.

——— An Eighty-eight Pound Ovarian Cyst Successfully Removed from a Patient Seventy-seven Years of Age.—*Journal of the American Medical Association,* December 19, 1903.

Charles E. Simon, M. D. A Case of Myelogenous Leukæmia with Severe Unusual Features (absence of eosinophilic leucocytes).—*American Journal of the Medical Sciences,* Vol. CXXV, June, 1903, p. 984.

——— On the Occurrence of Ehrlich's Dimethylamidobenzaldehyde Reaction in the Urine.—*American Journal of the Medical Sciences,* Vol. CXXVI, September, 1903, p. 471.

Frank R. Smith, M. D. Extracts from the Writings of Wilhelm Griesinger, a Prophet of the Newer Psychiatry.—*American Journal of Insanity,* July and October, 1903.

Walter R. Steiner, M. D. Report on the Progress of Medicine, 1902.—*Transactions of the Connecticut Medical Society,* 1903, pp. 113-125.

William S. Thayer, M. D. On Arteritis and Arterial Thrombosis in Typhoid Fever.—*New York State Journal of Medicine,* January, 1903, III, 21-28.

——— Preliminary Report of the Tuberculosis Commission of Maryland, December 14, 1903.

Henry M. Thomas, M. D. The Anatomical Basis of the Argyll-Robertson Pupil.—*American Journal of the Medical Sciences,* December, 1903.

J. H. J. Upham, M. D. Some of the Unusual Complications of Chronic Nephritis.—*Columbus Medical Journal,* 1903.

——— Water-borne Diseases.—*Columbus Medical Journal,* 1903.

Louis W. Warfield, M. D. Acute Ulcerative Endocarditis Caused by Meningococcus (Weichselbaum).—*University of Pennsylvania Medical Bulletin,* July-August, 1903.

——— A Mild Case of Acute Dysentery Yielding *Bacillus dysenteriae* (Shiga) in Large Numbers.—*Bulletin of the Ayer Clinical Laboratory of the Pennsylvania Hospital,* No. 1, October, 1903.

——— A Plea for the Microscopic Examination of the Blood in the Continued and Remittent Fevers Common to our Southern States.—*Atlanta Journal-Record of Medicine,* November, 1903.

——— Some Practical Points taught by the Discovery of *B. dysenteriae* in the Stools of Infants Suffering from Summer Diarrhœa.—*Medical Record,* Vol. 64, November 7, 1903.

——— The Report of a Series of Blood Cultures in Typhoid Fever.

Andrew H. Whitridge, M. D. The Significance of Intermittent Albuminuria in Life Insurance Work, with a Report of a Case.—*Medical Examiner and Practitioner,* November, 1903.

J. Whitridge Williams, M. D. Obstetrics. A Text-Book for the Use of Students and Practitioners, 1903.—*D. Appleton & Co.,* New York, pp. 845.

——— Indications for and the Most Approved Methods of bringing about Premature Labor and Accouchement Forcé.—*American Gynecology,* Vol. III, 1903, pp. 13-31.

——— A Sketch of the History of Obstetrics in the United States up to 1860.—*American Gynecology,* 1903, pp. 266-294, 340-366. Also *Siebold-Dohrn's Geschichte der Geburtshülfe,* Vol. III, Tübingen, 1903.

J. L. Yates, M. D. Notes on the Experimental Production of Specific Cytolysins for the Adrenal, Thyroid and Parathyroid Glands of Dogs.—*University of Pennsylvania Medical Bulletins,* July-August, 1903.

——— Dissecting Aneurysm of the Aorta, with a Report of a Case.—*Wisconsin Medical Journal,* December, 1903.

Hugh H. Young, M. D. Conservative Perineal Prostatectomy. A Presentation of New Instruments and Technic.—*Journal of the American Medical Association,* October 24, 1903.

NOTES ON NEW BOOKS.

Human Placentation; an Account of the Changes in the Uterine Mucosa and in the Attached Fetal Structures during Pregnancy. By J. Clarence Webster, B. A., M. D. (Edin.), F. R. C. P. E., F. R. S. E. With 233 illustrations. (*Chicago: W. T. Keener and Co., 1901.*)

The author of this book deserves credit for the breadth of view with which he approaches his subject. It is, he says, his conviction that a satisfactory knowledge concerning the development of the human placenta can only be obtained by carrying on a careful phylogenitic study in connection with the direct investigation of the human uterus. In pursuance of this idea, he has not only examined the pregnant uterus in all its different stages of development, but has made a careful study of the same periods in a number of animals, e. g., the rat, pig, sheep and cow. He has, moreover, examined a number of complete abortions in the early weeks, besides investigating the normal mucosa of the non-pregnant uterus, without which he does not think the changes occurring in pregnancy can be rightly understood. These elaborate and painstaking researches cover a period of eleven years. Their results are clearly and concisely presented, and their value is greatly enhanced by the number of excellent illustrations, which were prepared largely by the author himself, and represent much time and pains. It is, perhaps, a matter for regret that they should be separate from the text, since this arrangement necessitates a constant shifting of attention; but, on the other hand, it has the advantage of enabling the reader to follow the plates with their accompanying descriptions consecutively, and thus gain a better general impression of the process of evolution they depict than would otherwise be possible.

The American Text-book of Obstetrics. Edited by Richard C. Norris, M. D., and Robert L. Dickenson, M. D., Art Editor. Second edition, revised; with nearly 900 illustrations. (*Philadelphia and London: W. B. Saunders and Company, 1902.*)

The object of this volume, as stated in the preface, is, *par excellence*, that "of making clear those departments of obstetrics which are at once so important and usually so obscure to the medical student." As this is its avowed purpose, it is perhaps unreasonable to object that too much time and space are devoted to the pathologic side of labor and too little to the physiologic or normal side. Nevertheless, it is impossible to forbear a protest as to the unnecessary prominence given to the unusual and abnormal aspects of labor. Out of 1054 pages (exclusive of indices) contained in the two volumes only 173 are devoted to normal labor, including its mechanism, and it is impossible to avoid the reflection that a student educated along these lines might come to the first labor case, for which he is individually and primarily responsible, fully prepared to do a podalic version or a Caesarean section, but not altogether equal to the demands of a normal parturition.

Apart from this defect, however, the book is prepared in the best possible manner. The choice of writers, originally carefully and prudently made, has been correspondingly carried out in the changes which death has made necessary in this, the second edition, and their respective subjects have received thorough treatment. Some of the chapters, those, for instance, on dystocia and the pathology of pregnancy, are written in a style unusually animated and interesting, while the constant introduction of illustrative cases, briefly cited, adds greatly to their readable qualities.

Both volumes are liberally illustrated, and the illustrations have been executed on a carefully considered scheme which gives them additional value. The invariable selection, for instance, of the left half for sagittal sections, in preference to the practice hitherto employed, of using right or left indifferently, is a most desirable change. A little too much realism may possibly characterize some of them, but on the whole they are suitable and valuable, especially those in the section on dystocia arising from abnormalities of the fetus.

The section on the new-born infant is unusually full and complete, as well as that on obstetric surgery.

The manner in which the names of contributors are presented is not, in our opinion, sufficiently emphatic. They are appended, in parenthesis, to the titles of their respective sections in the table of contents, and the fact that the type used for the author's name is smaller than that used for the title of the subject must cause it (we speak from experience) to be sometimes overlooked.

In spite of such defects, however, the work is well calculated to fill a valuable place in the literature of its subject, namely, that of presenting the views of a number of individuals, each especially well informed on the subject of which he treats, in such a manner as to form an harmonious whole.

Modern Obstetrics; General and Operative. By W. A. Newman Dorland, A. M., M. D. Second edition, revised and enlarged; with 201 illustrations. (*Philadelphia and London: W. B. Saunders and Co., 1901.*)

This volume is characterized by an unusual and very pleasing display of common sense on the part of the writer. The section on normal labor, he fitly denominates "Physiologic Obstetrics," and lays strong emphasis on the fact that although in our present advanced stage of civilization parturition is too often accompanied by difficulties and dangers wholly unknown under simpler conditions of life, it should never be forgotten that labor is essentially a purely physiologic process.

The pathological side of the book, however, in no way suffers from the prominence given to the physiological. The utmost care has evidently been taken to collect the fullest possible information in regard to every abnormal condition and the essentials have been discreetly selected and concisely expressed. The chapter on puerperal sepsis is especially valuable, treating as it does of a condition only recently understood, and one in regard to which our knowledge is still undergoing evolution. Dr. Dorland's division of this subject into two classes—general and local—is sensible and useful, and his treatment of the different indirect manifestations accompanying each condition is well calculated to give them the prominence they deserve.

In considering the question of diagnosis between puerperal sepsis and other pathologic conditions, Dr. Dorland remarks acutely that "the general physician is so averse to admitting, even to himself, that he has a case of sepsis on his hands that he is very prone to argue himself into believing that his patient is suffering from an attack of some other intercurrent affection, as an enteric fever or an influenza." In our large cities, obstetrics is becoming yearly more and more the work of a specialist or semi-specialist, but elsewhere it is, and must remain, almost entirely in the hands of the general practitioner, and therefore the truth contained in the above remark, and the hints accompanying it for the guidance of the physician at large in this particular, are especially worthy of attention. All the most modern forms of treatment of puerperal sepsis are given very fully, and the reasons for or against each are stated with fairness.

The section on diseases of the genito-urinary tract is also very complete, especially as regards puerperal eclampsia, which receives its due meed of consideration. It is perhaps to be regretted that the text is quite so much burdened with statistics and percentages, but this is a trivial defect.

The number of illustrations is not large, but it is sufficient, and it is, on the whole, rather pleasurable than otherwise to find ourselves reading a text-book in which the process of thought is allowed opportunity for exercise without pictorial distraction, in contrast to the numbers of such volumes in which the succession of illustrations is so constant and so rapid that reflection and deduction are rarely allowed fair play.

No book is without faults, and one who looks for them here will, of course, be able to find them, but the work is a valuable one and the literature of the subject is the better for it.

Atlas and Epitome of Labor and Operative Obstetrics. By Dr. Oskar Schaeffer, Privat Docent in Obstetrics and Gynecology in the University of Heidelburg. Authorized translation from the fifth revised German edition; with 14 lithographic plates in colors and 139 other illustrations. (*Philadelphia: W. B. Saunders and Co., 1901.*)

This book, as its name indicates, is essentially a volume of illustrations, the text being really but complemental in function. To express the amount of information requisite for such a purpose in so condensed a form is not an easy matter; the writer, however, is evidently thoroughly familiar with the practical details of his subject and possesses a grasp of its fundamental principles sufficiently firm to permit of his attaining his object in a satisfactory manner. To say that condensation is carried a little too far may be treason to the purpose of the book, nevertheless, a passing doubt arises as to whether the information imparted would not in the end be better assimilated if it were somewhat less condensed; or rather, to put the matter on a broader basis, whether other and fuller methods of instruction are not really those best adapted to the real end in view, namely, the acquisition of knowledge. This is not the time and place, however, to engage in the discussion of so fundamental a question, and the number of editions through which the book has passed seem to afford sufficient guarantee that it meets with popular requirements. The general arrangement of the book is excellent, and its main divisions are well calculated to give the student a clear understanding of the broad outlines of the subject. The illustrations which form so integral a part of the work are well chosen for their purpose, and arranged to advantage. A word of favorable comment is due to the translator, whose work is not only accurate and clear, but, so far as the extreme condensation of style permits, is smooth and easy.

A Text-Book of Pathology and Pathological Anatomy. By Dr. Hans Schmaus; translated from the sixth German edition by A. E. Thayer, M. D.; edited with additions by James Ewing, M. D. 602 pages, with 351 engravings, including 35 colored plates. (*Philadelphia and New York: Lea Bros. & Co., 1902.*)

As we already have several satisfactory elementary text-books of pathology written in the English language, it is difficult to appreciate the necessity of a translation of Schmaus's text-book. But granting the desirability of a translation, it is unfortunate that more care was not given to the English in which it is clothed. One is impressed throughout the book by the fact that he is reading a translation. There is a close adherence to German order and a studied avoidance of the English idiom, which seems often to obscure the meanings, and would leave a beginner in pathology quite in the dark.

The general scope of the book is well stated by the editor in the preface, in the following words: "The author has not attempted to compete with the more discursive works of his countrymen, but has endeavored to write a shorter, more compact but equally comprehensive book, embodying all the important principles and facts that should be brought before students of pathology. There is a notable absence in these pages of the argumentative style, the quotation of authorities and the pursuit of personal opinion that are prominent features in the larger works and likewise absent is the full discussion of many topics that properly belong to a work of reference."

As a work of that nature, the book is to be commended. It is short and compact, so much so that the chapters at times seem but a series of definitions. It is comprehensive, including sections on general pathological processes, on parasites and on special pathology. There is almost an entire absence of the quotation of authorities for statements, and yet in spite of lack of "pursuit of personal opinion" one finds positive statements on subjects not generally accepted as entirely settled. The illustrations are, as a rule, good, though some of the colored plates, those which are printed in but a single color, would seem to be a useless expense, for though bright colors may be pleasing to the eye and also an important factor in making a book sell, the true value of a colored plate is supposed to lie in the detail that may be brought out by contrasting colors. But all in all it may be said that, barring the English, the author and editor have well fulfilled their intention. It is toward their "intention," or the condensed, comprehensive, elementary text-book in the abstract, that further criticism is directed. It does not seem to the reviewer that pathology in all its phases is a subject that can be treated in a highly satisfactory manner in a book of 600 pages of large type well leaded, and with a goodly proportion of space taken up by illustrations. Subjects must necessarily be treated in a sketchy, inexact, unscientific manner, without evidence to warrant conclusions drawn, or discussion of mooted questions, a condition which must fail to meet the demands of the student of pathology, who is, as a rule, an individual of a more, rather than less, mature mind, which has outgrown the habit of swallowing unquestioned what is placed before it. Nor does it seem just to the student to give him but one side of a question; for example, in speaking of cirrhosis of the liver, to tell him only, that "the essential element is the formation of granulation tissue between the lobes and its conversion into contracting cicatricial tissue with consequent atrophy of the hepatic cells" when "the other half-Rome" believes the hepatic atrophy primary. Even if the student were not able to decide for himself between the two views, statement of both would leave him with an open mind. To fall from the abstract to another concrete example; how firm a basis for the understanding of the etiology of dysentery is given the student, when to the author's statement that "In tropical cases the presence of amœbæ is characteristic and it is questionable whether our dysentery of hot weather is identical with the tropical type," is appended the editor's parenthetical note, "Both are probably referable to a specific bacillus—Bac. of Shiga."? If author and editor are in doubt, is not the reader entitled to a plain statement of pathological findings lest he be in worse darkness than simple ignorance? Briefly the ideal text-book seems, to the reviewer, one in which facts and their intepretation are clearly separated—and labelled—in which authority for statements is given, and in which important questions shall be discussed and the opinion of the author given in a critical review of existing opinions.

Clinical Pathology of the Blood. By James Ewing, A. M., M. D., Professor of Pathology, Cornell University Medical College, New York City. Illustrated with 43 engravings, and 18 colored plates drawn by the author. Second edition, revised and enlarged. (*New York and Philadelphia: Lea Brothers & Co., 1903.*)

In discussing this book, it should be borne in mind that its subject is "clinical pathology." It is the work of a pathologist, not of a clinician, and all the matter contained therein which concerns the clinical side of the question is quoted from literature. But the pathology of blood diseases is, perhaps, more than that of any other one branch of medicine, a subject of speculation and theory, with scarcely a single chapter (even the origin of red blood cells) resting on a basis of generally accepted ideas. Hence we may expect each edition to differ markedly from the preceding. This book is of very great assistance to those who are following current literature. It is, in fact, chiefly an epitome of literature, most of which deals with parts of the subject in which the author claims no authority or experience; hence his conclusions, based not on his own work but on the study of literature, are often inconclusive, the words "possibly" and "probably" being often repeated. We regard it unfortunate that a set of new plates was not prepared for this edition. The representations of leucocytes and malarial parasites are surely inadequate. Had some of the English writers seen these plates earlier, they would never have wasted their term "chromocytes" on red blood cells.

The author's English is not above reproach. No one can dispute his right to coin a new word if he wishes to do so, but he should be careful not to take too many liberties with old terms. The word "englobe" (page 176 et alt.) is a case in point. The use of "eflagellation (page 431), "spore" and "sporulation" (page 435 et alt.) applied to the malarial parasite, and "endothelia" (page 178), referring to cells, is, we think, open to criticism, although it may be a matter of taste. But surely the term "*crioscopy*" (κρίος ram instead of κρυός cold) will please college fraternity men more than teachers, and the description of the same will be appreciated by the physical chemist who does not consider the "laws" governing cryoscopy as absolutely "invariable," nor "elements" a proper term for the substances in solution, and Donné's name is repeatedly misspelled.

In the chapter on blood plates (which, by the way, deserves mention in the index), page 186, the very important method of Deetjen deserves more mention, and, even though his opinions are not accepted, the very positive opinions expressed must offend some of the best authorities on the subject.

The change mentioned on page 239 in the bulk of blood in leukæmia may occur in some cases, but the reverse also occurs.

The chapter on malaria is not at all satisfactory. We wonder if it has the same effect on others living in regions where malaria is common and who have plenty of opportunity to study fresh blood specimens in preference to using "improvised" (page 435) polychrome methylene blue; yet if the author can really get the details he pictures in the organism he is to be congratulated; it is the plates which to us seem "improvised." Considering the subject of the book, here is just the place one would expect to find the mosquito side of the subject well discussed, yet it is much neglected.

For a discussion of recent theories on the many problems of blood, this book is interesting, but beyond this little can be said in its praise.

Functional Diagnosis of Kidney Disease, with Especial Reference to Renal Surgery. By DR. LEOPOLD CASPER and DR. PAUL FRIEDERICH RICHTER. (*Philadelphia: P. Blakiston's Son & Co., 1903.*)

This little book appeared at a very opportune time, for cryoscopy was fast becoming the popular fad, and these two observers are particularly able to estimate its value. All the ordinary methods of determining the functioning power of each kidney, the vital problem for the surgeon, are discussed. The authors conclude that the only method of value is to examine the urine secreted simultaneously by each kidney, and to do this catheterization of at least one ureter is necessary. These urines are examined as regards both the molecular concentration, determined by the freezing method, and the excretion of sugar after the injection of phloridzen. The cases cited are very instructive.

The Practical Medicine Series of Year Books; under the General Editorial Charge of GUSTAVUS P. HEAD, M. D. Vol. VI. General Medicine. Edited by FRANK BILLINGS, M. D., and J. H. SALISBURY, M. D. (*Chicago: The Year Book Publishers, 40 Dearborn Street, May, 1903.*)

This is a good, clear, satisfactory résumé of the literature chiefly on diseases of the digestive organs, published during the year 1902. The many reviews are sufficiently long and are well digested.

A Guide to the Practical Examination of Urine. For the Use of Physicians and Students. By JAMES TYSON, M. D., Professor of Medicine, University of Pennsylvania. Tenth edition, revised and corrected. (*Philadelphia: P. Blakiston's Son & Co., 1902.*)

This excellent work has now reached its tenth edition. It is small, compact and contains just what and only what a physician needs to guide him in ordinary urine analysis. That, however, it is a good book for students we are not quite so sure. At least once in his education a student should read and practice a good deal of urine analysis which may not now be practical, but a knowledge of which is necessary if he would understand much of current work, which we hope may be practical in the near future.

Clinical Examination of the Urine and Urinary Diagnosis. A Clinical Guide for the Use of Practitioners and Students of Medicine and Surgery. By J. BERGEN OGDEN, M. D., Assistant in Clinical Pathology, Boston City Hospital. Illustrated. Second edition, thoroughly revised. (*Philadelphia, New York, London: W. B. Saunders & Co., 1903.*)

This is a splendid text-book, and much to be recommended. The chapters on qualitative examination are especially good; as regards the quantitative work, we very much doubt if it fulfills the author's hope that the student and practitioner who have not had special training in urinary analysis may by its use obtain accurate results. Methods of quantitative analysis cannot be thus condensed in half a page, and a student without previous training would be forced to use a book like Neubauer and Vogel, which, although written for those with previous training, discusses minutely each step of a process which this author merely states. For instance, we can imagine the perplexity of one who tries for the first time to determine total nitrogen. (The indexing of this chapter is peculiar.) On the other hand the hypobromite methods of urea determination are carefully described although we fear their value is doubtful, and the Schöndorff method, in our opinion, the best, although the hardest, is omitted.

It may seem a small point, but experience has taught us its value, and that is to avoid the use of the term "polariscope" for the instrument used in the quantitative estimation of sugar (page 162). As a physical instrument the polariscope has a scale which reads degrees, and tubes of 10 cm. length or some multiple of this, and such an instrument is seldom used in the clinic. That the instrument may read per cent of glucose, either the scale or the length of tube is modified, hence the term "saccharometer" is safer. Of course, if the observer has had no experience with the polariscope of the physical laboratory this point will not trouble him, but if his preliminary education has been thorough the instrument of the clinical laboratory will bother him, for he will try to use the specific rotation of glucose as the coefficient of the reading.

The chapter on β oxybutyric acid is, we think, very insufficient. This body is of considerable clinical interest and approximate quantitative determinations are within reach of one with a polariscope without undertaking the terrible procedure the author describes, which is the only one for isolation. The difference, rotation of a urine before and after fermentation, and, better still, the difference between the amount of sugar calculated with the polariscope and careful titration with Fehling's solutions will, due allowance being made for other optically active bodies, give an idea of the amount of the acid present.

The chapter on urinary sediments is excellent. We, however, also have had "exceptional opportunities for the study of cells from the ureter, but confess our inability to recognize from an epithelial cell its source in the urinary tract (see page 246).

The part on Diagnosis almost takes one's breath away. It occupies over one hundred pages. The classification of forms of nephritis may be pathological, but clinically it is too fine, and the aid the urine gives us in differentiating them could have been put in ten or fewer pages. Recognizing, however, that it is not safe to criticise an excess of the knowledge of another over our own, we confess with humility that we have not yet attained unto the skill in the urinary diagnosis which the author of this chapter must possess.

While we believe that in the chapters on chemistry the author has condensed methods to such an extent that it is difficult to follow their description, and while we think that the chapters on diagnosis are much too minute, we believe the book to be the best in English, and recommend it with pleasure.

Tuberculosis of the Female Genitalia and Peritoneum. By JOHN B. MURPHY, M. D. (*Chicago: 1903.*)

This is an elaborate presidential address delivered before the Chicago Surgical Society in October, 1903. In the first portion of the monograph, Murphy deals exhaustively with the avenues through which the organisms gain entrance to the pelvic structures. The literature on the subject is carefully reviewed. Tuberculosis of the vulva and vagina is interestingly discussed from the clinical and pathological standpoints. The chapter on tuberculosis of the cervix is full and most instructive. Considerable space is allotted to tuberculosis of the body of the uterus, and Murphy sums up by saying, "The diagnosis in most cases must be cleared up by an examination of the uterine scrapings." We thoroughly agree with him in advocating complete removal of the uterus. He prefers the vaginal route, since by this avenue there is less danger of contaminating the peritoneum. Murphy thinks that the portion of the tube first involved is that within about half an inch of the uterus and that the lodgment at this point is due to extreme narrowing of the tube lumen. From several experiments Murphy found that tuberculous tissue introduced into the abdomen, produce lesions in the lower half of the abdomen, and in the few months intervening between the inoculation and the animal's death that neither the mucosa of the tubes nor that of the uterus showed any evidence of tuberculous involvement.

Excellent details of the clinical phenomena of cases of tuberculosis of the tubes are given and a very careful and conservative treatment recommended. Tuberculosis of the ovary is briefly and yet satisfactorily discussed.

Tuberculosis of the peritoneum is accorded a liberal consideration. The various modes of infection are outlined, especial emphasis being laid on the rôle played by tuberculous Fallopian tubes. These expell from time to time caseous material into the pelvis and occasion exacerbations of the tubercular peritonitis. Murphy thinks that primary tuberculosis of the appendix is frequently responsible for subsequent tubercular peritonitis. Peritonitides of this character are grouped as follows: (1) The disseminated exudative and non-confluent serous variety. (2) The nodular ulcerative or perforative variety. (3) The adhesive fibro-plastic cystic circumscribed abscess partition or obliterative variety. (4) Tubercular peritonitis with mixed infection.

Under treatment, Murphy says, "The surgical or medical treatment of tuberculosis of the peritoneum involves four propositions: (1) To remove or shut off the source of supply to the peritoneum of new tubercular debris. (2) To remove the products of the infective process from the peritoneum. (3) To increase the tissue proliferation for the encapsulation of the foci already present. (4) To avoid mixed infection.

After reviewing the results of others, Murphy shows his faith in operative interference by the following: "The value of operative intervention can no longer be said to be in question."

In the disseminated serous variety mere abdominal section is of little value. For success it is necessary to remove the original focus, which is likely to be a Fallopian tube, the appendix, or possibly a mesenteric gland. It is in this class of cases that the most gratifying results have been noted.

In the nodular ulcerative and perforative variety, and also in the adhesive form, the sphere of surgical interference is limited and is on the whole unpromising. Murphy lays especial stress on the dangers of producing fæcal fistula in these cases as the intestines are often intimately blended with the abdominal wall and are readily cut into as the peritoneum is being opened. Or, again, when gentle traction is made on adherent intestinal loops, they are liable to rupture.

In dealing with the mixed infection variety where circumscribed abscesses exist, or where general suppuration is present, he advises evacuation followed by closure without drainage. Drainage was abandoned on account of the uncontrollable and permanent purulent discharge that followed where the open treatment had been employed.

This contribution of Murphy's has entailed much labor, is of interest to the pathologist and contains many practical hints for the surgeon and general practitioner. It is worthy of a thorough perusal by every medical man.

The Surgical Diseases of the Genito-Urinary Organs. By E. L. Keyes, A. M., M. D., LL. D., and E. L. Keyes, Jr., A. B., M. D., Ph. D. With one hundred and seventy-four illustrations in the text and ten plates, eight of which are colored. *(New York and London: D. Appleton and Company, 1903.)*

This volume of 800 pages is a second revision of Van Buren and Keyes' Genito-Urinary Diseases with Syphilis, which was written some thirty-five years ago. Since the first appearance of this book the tendency has been to make it less venereal and more genito-urinary, hence the change in title. In the present edition syphilis has been entirely eliminated, as it is a genital disease only in its manner of attack. Gonorrhœa, however, although a venereal disease, has received the extended consideration which its overshadowing importance demands. It is so intimately associated with the inflammatory conditions of the urethra and so far-reaching in its effects that it merits the space and careful attention given it.

We hesitate to criticise the opinions of the authors based, as they are, on such wide and extensive personal experience. But on such important questions as the treatment of prostatic hypertrophy, ureteral catheterization and the use of the cystoscope we feel that their attitude is too conservative. In the treatment of prostatic hypertrophy in the class of cases suitable for a cautery operation we doubt very much if any who have had a considerable experience with the Bottini operation would admit the advantage claimed by the authors for Chetwood's operation.

We are very much surprised to find the indications for cystoscopy summarized as follows: (1) In tuberculosis of the bladder to decide a question of operation; (2) ureteral catheterization; (3) tumor, and (4) in obscure cases, for diagnosis. Just what is included under the last heading, obscure cases, will depend largely on the individual operator's interpretation of the term obscure, but in no way can it be interpreted to apply to cases of hypertrophy of the prostate. To quote, "Many surgeons constantly employ the cystoscope for the diagnosis of hypertrophy of the prostate, stone in the bladder and cystitis. I do not consider it a proper routine method of diagnosis for any of these conditions."

In our experience there is no method of examination so simple and giving data at once so accurate and indispensable in cases of hypertrophy of the prostate as cystoscopy. Indeed, we do not understand how a surgeon can intelligently perform any of the cautery operations without first making a careful cystoscopic examination of the prostatic orifice. And the same holds good for any operative interference with the prostate.

We are sorry the silk filiform bougies with steel followers and the Kollmann dilators have not found greater favor with the authors. We believe they deserve greater consideration than they have received.

But these are doubtless minor points about which there is at present a great variety of individual opinion. And they do not detract from a text-book which is easily the best we have in this branch of surgery. It is also the best book on the subject to put into the hands of students.

Diseases and Injuries of the Eyes, with their Medical and Surgical Treatment. By George Lawson, F. R. C. S. Eng., Surgeon Oculist-in-ordinary to her Majesty the late Queen Victoria; Consulting Surgeon to the Royal London Ophthalmic Hospital and to the Middlesex Hospital. Sixth Edition, with 249 illustrations. Revised and in great measure rewritten by Arnold Lawson, F. R. C. S. Eng., Assistant Surgeon to the Royal London Ophthalmic Hospital; Consulting Surgeon to the Paddington Green Children's Hospital, etc. *(London: Smith, Elder & Co., 15 Waterloo Place, 1903.)*

Eighteen years have elapsed since the last previous edition of this work was issued, and probably the majority of ophthalmologists practicing to-day are entirely unfamiliar with it, but those who do recall that it was a standard manual in its day, or who have been in the habit of referring to it even later, regard it very highly because of the excellence of its practical advice on the treatment of the various eye affections. The son has done well to retain this distinctive feature.

A better illustration of the advances that have taken place in ophthalmology in the last two decades could scarcely be found than is afforded in a comparison of the fifth and sixth editions of this work. The volume of material has been multiplied three or four times and still the enlarged edition contains the concise, condensed form of the smaller. The increase consists of new subjects introduced, numerous new illustrations, and a new and broader treatment of old topics.

We can very heartily commend the book to all persons interested in a study of eye diseases, especially to the specialist as a reference book, on account of the broad and complete consideration of pathology and treatment. One feature that particularly pleases us is the attention given to errors of refraction. It is refreshing to see an English text-book treat this subject so well and we hope our European confreres may soon be following the good example. There are a few points in the chapter on hypermetropia that might be criticised, and there are evidences that the Americans are still leading in the amount of care and attention given to the correction of small errors, especially of an astigmatic nature. However, we need not push the criticism too hard, since we have evidence of a marked advance and the future is hopeful.

Any allusion to the differences between American and foreign practice reminds us that the book contains very slight reference to American work, almost ignoring it, in fact, and, by virtue of that fact, we miss some of the seemingly really important advances in ophthalmology. Neither do we find any mention of the newer remedies, such as protargol, argyrol, etc.

In the chapter on Diseases of the Lachrymal Apparatus no more attention is paid to the work of Bowman, a fellow-countryman of the author, or of Theobald than if they had never existed. The book is, throughout, rather the expression of the author's personality, and we like it for that fact, but the epoch-making discoveries I refer to should not be ruthlessly cast aside. We have shown elsewhere that the opposition to large probes is without any reasonable support, and we wonder at the persistent refusal even to try them.

Beyond these few slight adverse criticisms, we wish to record our endorsement of Lawson's work. It is a very valuable addition to our working library and a book that we shall certainly appeal to frequently. The publisher's part has been very well done and the paper upon which it is printed is particularly deserving of remark. H. O. R.

A System of Physiologic Therapeutics. Edited by S. Solis Cohen, A. M., M. D. Vol. X. Pneumotherapy, including Aërotherapy and Inhalation Methods and Therapy. By Dr. Paul Louis Tissier, Chief-of-Clinic in the Faculty of Medicine of the University of Paris. Illustrated. (*Philadelphia: P. Blakiston's Son & Co., 1903.*)

The tenth volume of this system deals with the subject of "Pneumotherapy, including Aërotherapy and Inhalation Methods and Therapy."

In general the plan of this book agrees with that of the previous ones of the system, except that in the second part—that part dealing with inhalation methods—the application of various drugs by this method has been discussed at considerable length. While this constitutes a departure from the strict letter of the title of the system, nevertheless the value of the book has been materially increased, thereby, this chapter being one of the best of the book.

A large part of the book is taken up with a discussion of physiological questions. While much of this discussion is very interesting, the relation of some of it to the subject in hand is not very apparent, and not infrequently some of the best work on the topics discussed has been overlooked. Much space has been taken up with a description of the various kinds of complicated apparatus used for the application of condensed and rarefied air and combination of the two. On the other hand, the discussion of the therapeutic uses to which this apparatus is to be put occupies relatively a very small space and the conclusions are not always very clear. Some of the procedures are said to be beneficial for a remarkable number of conditions, the condensed air bath, for instance, being valuable in the treatment of many disorders—from heart-disease to toothache. As a multitude of remedies advised in a given disease raises skepticism in the student's mind as to the value of any, so a very extensive list of diseases in which a given procedure is said to be beneficial might tend to cause some undiscriminating readers to doubt its value in any.

Some curious statements are made in places as to the nature of the diseases treated, not always in accord with generally accepted views. For instance, the author says: "I consider emphysema as an attenuated, benign form of pulmonary tuberculosis, fibrous in its development from the beginning."

On the whole we cannot see that the author has made a very effectual plea for the more general employment of the procedures treated of in this book. A book one-fourth of the size could have contained all the matter of any importance which has a bearing on the subject treated, and, by careful editing and presenting the opinions and experiences of the author rather than those of a host of observers, it might have had much influence in bringing this somewhat neglected branch of therapeutics into greater repute among the medical profession.

Manual of Medicine. By Thomas Kirkpatrick Monro, M. A., M. D., Professor of Medicine in St. Mungo's College. (*Philadelphia and New York: W. B. Saunders & Co.*)

The author makes no claim for originality in this text-book of medicine, except in the matter of size, stating that some of the English treatises are too small, others are too large for the average student even to attempt to master. This seems rather an inadequate reason, if one were needed, for the appearance of this book—as though the study of medicine were a matter of linear measure. A perusal of the book convinces one, however, that the average student, like the student of the multiplication table or catechism, will still have much to learn, even after he has mastered all of its pages.

Possibly there is need for such a book. If so, the author has accomplished his purpose very well. Very few errors are apparent, and the author has chosen his material wisely, omitting a discussion of all debatable points and of newer work not definitely confirmed. This may make the book of more value for those students who desire bare facts, but certainly offers very little attraction to those who look for stimulation to thinking.

The book is very comprehensive, treating not only of all conditions usually included in the text-books on medicine, but containing in addition a section on diseases of the skin, and also considering briefly those subjects usually treated of in text-books on physical diagnosis and clinical miscroscopy. It cannot be considered very satisfactory, however, to treat of the physical diagnosis of the chest (heart and lungs) in about thirty pages, and to condense a discussion on the urine, including methods of examination, into about thirteen pages. It is to be feared that such conciseness and omission of detail may induce in the student a similar attitude of mind in the application of his knowledge to practical purposes. The directions of the author also do not always guard against this possibility. For instance, the statement is made that in the practical study of the heart, as a rule, the outline of the relative cardiac dulness is not of much value and only the outline of absolute cardiac dulness need be carefully studied.

In order to reduce the size of the book the publishers have cut down the margins of the pages, and in other respects the book is not attractive.

To those students desiring at a moderate price a small book covering a great field this book will probably appeal.

A Manual of the Practice of Medicine, prepared especially for Students. By A. A. Stevens, A. M., M. D., Professor of Pathology, Woman's Medical College of Pennsylvania. Sixth revised edition, enlarged. Illustrated. (*Philadelphia, New York and London: W. B. Saunders & Co., 1903.*)

Most readers are familiar with the former editions of this small book. The good features of the former editions have been retained in the present sixth one and a considerable number of minor changes have been made to bring this book up to date.

The selection of material has been made with care, and the work of editing has been well done. The paragraphs on treatment are very concise, but the directions are quite clear and in general the treatment advised has a rational basis.

The make-up of the book is attractive, the typographical work being excellent, and the flexible binding used on former editions being retained.

This book has in the past been largely used by students and practitioners for purposes of review and in preparing for examinations, and it is probable that this will continue to be the main use made of it. The danger, however, that students will use such books as text-books and in place of more extensive reading is great and should be guarded against by teachers.

When properly employed, however, books of this kind are of considerable value, and this is the most valuable one of its class that we have seen.

Atlas of the External Diseases of the Eye. By Prof. Dr. O. Haab, of Zürich. Second edition, thoroughly revised. Edited, with additions, by G. E. De Schweinitz, A. M., M. D., Professor of Ophthalmology in the University of Pennsylvania. With 98 colored lithographic illustrations on 48 plates, and 232 pages of text. (*Philadelphia, New York, London: W. B. Saunders & Co., 1903.*)

It seems surprising that we have had for so many years works containing accurate pictures of morbid conditions of the inner structures of the eye without any accompanying illustrations of the external diseases of this organ. It is true that the external diseases of the eye, especially inflammations of the cornea, do not lend themselves easily to illustration, but there are many infections which can be portrayed with considerable suggestiveness and the pictures of these conditions will be found a substantial help by all who attempt to do any work in the field of ophthalmology. Haab's contribution is the best of its kind and the appearance of a second edition is an evidence not only of the need for such a work but that the earlier edition was weighed and found to contain material of high grade. For many years Zürich has been strong in ophthalmology and hardly a year passes without some fresh and valuable token that the science still flourishes there. Most of the first half of the work is taken up with practical descriptions of the external diseases of the eye and their treatment and of the usual methods of examination, matter to be found in all text-books on the eye. The plates are forty in number and they illustrate every disease which can be recognized with one's naked eye. The paintings are all from nature and accompanying each of them there is a history of the patient. Occasionally we find a condition somewhat idealized, but the painting is none the less suggestive and with very few exceptions the collection contains truthful reproductions of old and familiar scenes, and we have no hesitation in advising its purchase and in predicting for it a growing popularity.

BOOKS RECEIVED.

Mammalian Anatomy, with Special Reference to the Cat. By Alvin Davison, Ph. D. With over one hundred illustrations made by W. H. Reese, A. M., from the author's dissections. 1903. 8vo. 250 pages. P. Blakiston's Son & Company, Philadelphia.

A Treatise on Orthopedic Surgery. By Royal Whitman, M. D. Second edition, revised and enlarged. Illustrated with five hundred and seven engravings. 1903. 8vo. 848 pages. Lea Brothers & Company., Philadelphia and New York.

Functional Diagnosis of Kidney Disease. With Especial Reference to Renal Surgery Clinical Experimental Investigations. By Dr. Leopold Casper and Dr. Paul Friederich Richter. Translated by Dr. Robert C. Bryan and Dr. Henry L. Sanford. 1903. 12mo. 233 pages. P. Blakiston's Son & Company, Philadelphia.

Clinical Treatises on the Pathology and Therapy of Disorders of Metabolism and Nutrition. By Prof. Carl von Noorden. Authorized American edition translated under the direction of Boardman Reed, M. D. *Part IV. The Acid Autointoxication.* By Prof. Dr. Carl von Noorden and Dr. Mohr. 1903. 8vo. 80 pages. E. B. Treat & Company, New York.

Infectious Diseases; Their Etiology, Diagnosis, and Treatment. By G. H. Roger. Translated by M. S. Gabriel. Illustrated with forty-three engravings. 1903. 8vo. 874 pages. Lea Brothers & Company, New York and Philadelphia.

Clinical Talks on Minor Surgery. By James G. Mumford, M. D. 1903. 16mo. 115 pages. The Old Corner Book Store, Boston.

Elements of Surgical Diagnosis. By A. Pearce Gould, M. S. Lond., F. R. C. S. Eng. Third edition, revised and enlarged. 1903. 16mo. 607 pages. W. T. Keener & Company, Chicago.

The Medical Epitome Series Normal Histology. A Manual for Students and Practitioners. By John R. Wathen, A. B., M. D. Series edited by V. C. Pedersen, A. M., M. D. Illustrated with one hundred and fourteen engravings. 1903. 12mo. 229 pages. Lea Brothers & Company, Philadelphia and New York.

The Right to Life of the Unborn Child. A controversy between Professor Hector Treul, M. D., Reverend R. van Oppenraay, D. D., S. J., Professor Th. M. Vlaming, M. D., 1903. 12mo. 125 pages. Joseph F. Wagner, New York.

A Non-Surgical Treatise on Diseases of the Prostate Gland and Adnexa. By George Whitfield Overall, A. B., M. D. 1903. 12mo. 207 pages. Rowe Publishing Company, Chicago.

Philadelphia Hospital Reports. Volume 5, 1902. Edited by Herman B. Allyn, M. D. 1903. 8vo. 178 pages. Philadelphia.

Transactions of the American Surgical Association. Volume the twenty-first. Edited by Richard H. Harte, M. D. 1903 8vo. 630 pages. Printed for the Association, Philadelphia.

Medical and Surgical Reports of the Boston City Hospital. Fourteenth Series. Edited by Herbert L. Burrell, M. D., W. T. Councilman, M. D., and Charles F. Withington, M. D. 1903. 8vo. 178 pages. Published by the Trustees, Boston.

A Text-Book of Practical Gynecology. For Practitioners and Students. By D. Tod Gilliam, M. D. Illustrated with 350 engravings, a colored frontispiece, and 7 full-page half-tone plates. 1903. 8vo. 634 pages. F. A. Davis Company, Philadelphia.

The Lymphatics. General Anatomy of the Lymphatics, by G. Delamere. Special Study of the Lymphatics in Different Parts of the Body, by P. Poirier and B. Cunéo. Authorized English edition, translated and edited by Cecil H. Leaf. With 117 illustrations and diagrams. 1904. 8vo. 301 pages. W. T. Keener & Company, Chicago.

Atlas of the External Diseases of the Eye. Including a Brief Treatise on the Pathology and Treatment. By Prof. Dr. O. Haab, of Zürich. Authorized translation from the German. Second edition, revised. Edited by G. E. de Schweinitz, A. M., M. D. With 98 colored lithographic illustrations on 48 plates. 1903. 12mo. 232 pages. W. B. Saunders & Company, Philadelphia, New York, London.

The Anatomy of the Human Peritoneum and Abdominal Cavity. Considered from the Standpoint of Development and Comparative Anatomy. By George S. Huntington, M. A., M. D. Illustrated with 300 full-page plates containing 582 figures, many in colors. 1903. 4to. 292 pages. Lea Brothers & Company, Philadelphia and New York.

Blood-Pressure in Surgery. An Experimental and Clinical Research. The Cartwright Prize Essay for 1903. By George W. Crile, A. M., M. D. 1903. 8vo. 422 pages. J. B. Lippincott Company, Philadelphia and London.

A Pocket Book of Clinical Methods. By Charles H. Melland, M. D., Lond., M. R. C. P. 1903. 16mo. 88 pages. John Wright & Company, Bristol. Simpkin, Marshall, Hamilton, Kent & Company, Ltd., London.

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The Self-Cure of Consumption Without Medicine. With a Chapter on the Prevention of Consumption and Other Diseases. By Charles H. Stanley Davis, M. D., Ph. D. 1904. 12mo. 176 pages. E. B. Treat & Company, New York.

The Blues (Splanchnic Neurasthenia). Causes and Cure. By Albert Abrams, A. M., M. D. (Heidelberg), F. R. M. S. Illustrated. 1904. 8vo. 140 pages. E. B. Treat & Company, New York.

Third Biennial Report of the Board of Control of State Institutions of Iowa. For the biennial period ending June 30, 1903. 8vo. 1085 pages. Des Moines.

Practical Medicine Series of Year Books. Comprising Ten Volumes on the Year's Progress in Medicine and Surgery. Issued monthly, under the general editorial charge of Gustavus P Head, M. D. *Volume III. The Eye, Ear, Nose and Throat.* Edited by Casey A. Wood, C. M., M. D., D. C. C., Albert H. Andrews, M. D., Gustavus P. Head, M. D. December, 1903. 12mo. 332 pages. The Year Book Publishers, Chicago.

Diseases of the Nervous System. A Text-Book for Students and Practitioners of Medicine. By H. Oppenheim, M. D. Translated and edited by Edward A. Mayer, A. M., M. D. Second American edition, revised and enlarged. With three hundred and forty-three illustrations. 1904. 8vo. 953 pages. J. B Lippincott Company, Philadelphia and London.

The Complete Medical Pocket-Formulary and Physician's Vade-Mecum. Containing upwards of 2500 prescriptions, collected from the practice of physicians and surgeons of experience, American and foreign, arranged for ready reference under an alphabetical list of diseases. By J. C. Wilson, A. M., M. D. Third revised edition. 1903. 8vo. 268 pages. J. B. Lippincott Company.

International Clinics. A Quarterly of Illustrated Clinical Lectures and Especially Prepared Original Articles on Treatment, Medicine, Surgery, Neurology, Pediatrics, Obstetrics, Gynecology, Orthopedics, Pathology, Dermatology, Ophthalmology, Otology, Rhinology, Laryngology, Hygiene, and Other Topics of Interest to Students and Practitioners. Edited by A. O. J. Kelly, M. D. Volume IV. Thirteenth Series, 1904. 8vo. 321 pages. J. B. Lippincott Company, Philadelphia.

Clinical Pathology of the Blood. A Treatise on the General Principles and Special Applications of Hematology. By James Ewing, A. M., M. D. Second edition, revised and enlarged. Illustrated with forty-three engravings, and eighteen colored plates drawn by the author. 1903. 8vo. 495 pages. Lea Brothers & Company, New York and Philadelphia.

Diseases of the Eye. By L. Webster Fox, A. M., M. D. With five colored plates and two hundred and ninety-six illustrations in the text. 1904. 8vo. 584 pages. D. Appleton & Company, New York and London.

Social Diseases and Marriage. Social Prophylaxis. By Prince A. Morrow, A. M., M. D. 1904. 8vo. 390 pages. Lea Brothers & Company, New York and Philadelphia.

The Treatment of Fractures. With Notes upon a Few Common Dislocations. By Charles Locke Scudder, M. D. Fourth edition, thoroughly revised, with 688 illustrations. 1903. 8vo. 534 pages. W. B. Saunders & Company, Philadelphia, New York, London.

Lectures on Diseases of the Nervous System. Second Series. Subjective Sensations of Sight and Sound, Abiotrophy, and Other Lectures. By Sir William R. Gowers, M. D., F. R. C. P., F. R. S. 1904. 8vo. 250 pages. P. Blackiston's Son and Company, Philadelphia.

Biographic Clinics. Volume II. The Origin of the Ill Health of George Eliot, George Henry Lewes, Wagner, Parkman, Jane Welch Carlyle, Spencer, Whittier, Margaret Fuller Ossoli, and Nietzsche. By George M. Gould, M. D. 1904. 12mo. 392 pages. P. Blakiston's Son & Company, Philadelphia.

The Practical Medicine Series of Year Books. Comprising Ten Volumes on the Year's Progress in Medicine and Surgery. Issued monthly, under the general editorial charge of Gustavus P. Head, M. D. *Volume II. General Surgery.* Edited by John B. Murphy, M. D. November, 1903. 12mo. 556 pages. The Year Book Publishers, Chicago.

The Physiognomy of Mental Diseases and Degeneracy. By James Shaw. 1903. 12mo. 83 pages. John Wright & Company, Bristol. Simpkon, Marshall, Hamilton, Kent & Co., Ltd., London.

A Text-Book of Legal Medicine and Toxicology. Edited by Frederick Peterson, M. D., and Walter S. Haines, M. D. Volume II. 1904. 8vo. 825 pages. W. B. Saunders & Company, Philadelphia, New York, London.

A Handbook of Ophthalmic Science and Practice. By Henry E. Juler, F. R. C. S. With Illustrations. Third edition, revised and enlarged. 1904. 8vo. 733 pages. Lea Brothers & Company, Philadelphia.

Infant-Feeding in its Relation to Health and Disease. By Louis Fischer, M. D. Containing 54 illustrations, with 24 charts and tables, mostly original. Third edition. 1903. 8vo. 357 pages. F. A. Davis Company, Philadelphia.

The American Year-Book of Medicine and Surgery. Collected and arranged with critical editorial comments, by Samuel W. Abbott, M. D., Archibald Church, M. D., et al. Under the general editorial charge of George M. Gould, M. D. Volume I. Medicine. Volume II. Surgery. 1904. 8vo. W. B. Saunders & Company, Philadelphia, New York, London.

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VACCINE AND VACCINATION.[1]

By George Dock, M. D.,

Ann Arbor, Mich.

I intend to limit myself to a narrow part of the subject, and especially to the practical as distinguished from the scientific or theoretic side.

When we think of vaccination we must remember that if we are not wholly ignorant of the specific germs, we are still unable to make them serve as an index to the purity or quality of material, and we should also remember that we have no methods of dosage, such as make the application of diphtheria antitoxin and tuberculin fairly controllable. We recognize the effects of vaccine by the local results or by the immunity produced. For the former we have a more or less characteristic set of changes, ending in a peculiar and permanent scar. The immunity is not so easy to recognize in single cases, because we cannot tell how effective natural immunity might have been, and we rarely have more than the crudest notion of the degree of danger in a given case. When variolation was practiced the conditions were somewhat different, but with only casual exposure we are obliged to fall back, as proofs, on experiences with large numbers of people, where various degrees of thoroughness of vaccination and various degrees of danger of infection can be considered as neutralized by force of numbers.

The Material Used.

In the earliest days of vaccination the so-called lymph from vesicles on human beings was used. In Jenner's memorable experiment on James Phipps he used the virus from a cow-pox vesicle on the hand of a dairy-maid, but later he inoculated from a vesicle on the nipple of a cow. After a few transfers this stock died out, as the former had done, but soon after the publication of Jenner's first work several new strains were obtained. Many of these were kept on by inoculating from arm to arm, or indirectly, and so were spread all over the world. It is interesting to remember that in America the virus was introduced by Waterhouse in Boston and Hosack in New York, the Southern States being early supplied by Waterhouse through the interest of President Jefferson. Some of the early vaccine was kept up for a long time. Drake tells us that he could see no change in course or phenomena in that used in the West in the forty-four years following its introduction in 1802. According to Kaposi, the material in the Vienna Vaccine Institute was descended from some sent by Jenner to De Carro in 1802, and retained its efficiency in the late 80's. But it did not always keep so well. L. Pfeiffer mentions some that he saw a few years ago, of the same origin, so degenerated that it gave only a minimal areola and the scab dropped off on the 13th day.

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[1] Read before the Johns Hopkins Hospital Medical Society, January 4, 1904.

Even in the first few years after Jenner's announcement the degeneration of virus was often observed, and the search for new cow-pox virus was made. It became more lively in the 20's, stimulated by the revival of small-pox in many countries, often affecting vaccinated persons. Partly from the incomplete protection thus shown, partly from the imperfect development of the vaccine lesions, it was believed that the material in use was not as potent as it had been in the beginning. But as a result of the lessened prevalence of small-pox, natural cow-pox was much less frequent than in Jenner's time. Rewards were offered in some countries for the discovery of cow-pox. Retro-vaccination, or the inoculation of the cow with human virus, was used for the purpose of reviving the stock. About the same time, that is in the end of the first third of the nineteenth century, the value of revaccination became known, though it took many years to be fairly appreciated, and it is still ignored in some parts of the world.

Experiments for the production of cow-pox, by inoculating animals with small-pox virus, had been made by some in the early part of the century, and these were repeated, and in the hands of Ceeley and especially of Badcock, of Brighton, were successful. Badcock himself vaccinated over 13,000 persons with the virus, and furnished material to many physicians and apothecaries. It is an interesting fact that Dr. W. E. Coale, of Boston, "suspecting the efficiency of the virus then in use," obtained some of Badcock's material. In 1852, Badcock sent him some "crusts from a variolated cow, a glass charged with the same material, and some points charged from a vesicle on a child's arm," caused by some of the primary lymph. Badcock sent Dr. Coale some more material in 1855, though this was not direct from the cow. Drs. Adams, of Waltham, and Putnam, of Boston, repeated Ceeley's experiments successfully, according to a letter by Dr. Coale, dated April 6, 1852, in the *Boston Daily Advertiser*. Other experiments made from the time of Badcock down to a recent period, by various investigators, have demonstrated the possibility of obtaining vaccine virus by variolating cows, and although the results were opposed by Chauveau and his colleagues, their scientific and economic value is now universally recognized, while the occasional propagation of small-pox by vaccination from such animals is explained by obvious errors in technic.

But the great bulk of material used for vaccinating, down to the 70's, was humanized virus, inoculated either from arm to arm or indirectly. In large cities it was not difficult to keep up the succession, though the chief localities for that, foundling asylums, had certain important disadvantages. In the country and in small towns the supply often failed, or gave poor results. The methods used for keeping and inoculating vaccine in this period, other than by operating from arm to arm, are of some interest.

One of the earliest methods of preservation was by drying the lymph, obtained by puncturing a vesicle, on a piece of glass. This was tied together with another glass and the two kept dry until wanted. Another was to soak threads in the virus, dry them and keep them in bottles. Or the virus was dried on elongated glass stoppers and the stoppers fixed in bottles, or it was dried on lancets, quills, or even thorns. On account of the rusting of steel instruments, with damage to the latter if not to the virus, silver or gilt lancets were used. Needles were used sometimes, and a Dr. Carl, in Prague, invented a forked silver needle. Small glass tubes, such as barometer tubes, were also used, sealed at the ends by fusing. The use of crusts or scabs came comparatively late.

THE EARLY TECHNIC.

There were many modifications of the method of inoculating, though the details were for the most part derived from the earlier small-pox inoculations. Jenner first used short incisions, or punctures. When threads were used, they were cut in short lengths, placed in shallow incisions, and kept there by adhesive plaster. From the fact that some operators renewed the threads on the third day we may assume that the method was not always successful. Sometimes the dried material, on threads, glass or instruments, was softened by soaking in blood, or by exposing to the vapor of boiling water, or soaking in water, or even saliva. More complicated methods of getting an inoculating surface were sometimes followed. Cross-scratching seems to have been a later invention. Fly-blisters were used at an early period, even a skin-trepan was invented, and as late as 1902 a cautery-hammer was devised, for raising a blister, in the cavity of which vaccine was to be inoculated. At various times since the invention of the hypodermic syringe, that instrument has been used for injecting vaccine virus into the skin or subcutaneous tissue. Although it seems to serve the purpose, it has no great advantage, and some disadvantages.

One of the common details of vaccinating developed from the use of humanized virus, viz., the practice of making multiple lesions. It was thought that the taking of part of the lymph lessened the effect on the vaccinifer, and so several vesicles were produced, one at least being untouched. Although the protection afforded by one good vesicle has always been recognized, there is some reason for believing that protection is in proportion to the area of typical scar.

BOVINE VIRUS.

The growing realization of the inconveniences of humanized virus gradually led to the development of another method, but there were other reasons besides the technical ones. In the 60's the fear of transmitting syphilis by vaccination became intensified, and although investigation showed that the risk was slight, considering the large number of people vaccinated, it also proved that the danger was real.

The possibility of transmitting tuberculosis was also suggested by the work of Villemin, and was for a time much exaggerated. So attention was directed more and more to the use of bovine virus, that is, material raised purposely on the animal. In this way it was thought that the danger of setting up syphilis and tuberculosis could be avoided, and although the fear of transmitting inflammatory diseases was not absent, it did not retard the movement. In fact, then as now, there were some who thought that severe local reactions were desirable.

The use of bovine vaccine goes back directly to Negri, who cultivated virus on animals, in Naples, from 1842. It is said that the same method was begun in Naples early in the century, but prohibited by law. Negri's method and material were introduced in Paris in 1864, by Lanoix, who, however, adopted cow-pox virus from the celebrated spontaneous case discovered at Beaugency, France, in 1866. The method spread rapidly. It was introduced in Brussels in 1865, by Warlomont, and in Berlin, in the same year, by Pissin, and soon afterwards in Vienna. In 1870, Dr. Henry A. Martin, of Boston, an indefatigable investigator and cultivator of vaccine, imported some of the Paris material, just before the strain died out during the siege. For some time after bovine virus came into use, the method of preservation was chiefly that of coating ivory slips with virus obtained by puncturing vesicles, the bases of which were compressed by forceps. Scabs were also used. On the continent of Europe a popular method consisted in vaccinating directly from the calf, the animal being taken to the domicile or to a central location, as was most convenient.

The Use of Pulp.

At first the material used was the liquid part of the contents of the vesicle, as was necessarily the case in using human virus before the scab stage, but in the 80's the so-called pulp came into use. The reason for the change was complex, and had reference partly to the greater tenacity of the liquid part of the bovine vesicle as compared with that of the human one, and its greater tendency to coagulate. The pulp is the whole vesicle, made up of the cells of the skin in the lesion, leucocytes, red-blood corpuscles, fibrin, fat, specific and non-specific micro-organisms, and debris. Many objections have been made to the use of pulp vaccine, and from time to time these are brought forward in articles, but the arguments advanced are misleading, to say the least. Thus, it is said that pulp contains more pus and more bacteria than the liquid part obtained either by puncture of the vesicle or by tearing off the top of the vesicle and permitting liquid to exude from the base. But at the time the pulp is taken there is no pus in the ordinary sense, and it has never been demonstrated that the whole pulp contains more bacteria, bulk for bulk, than does the liquid part. Careful observations are needed in this connection, but at the present time it should be borne in mind that the best vaccine in every respect, that is, the virus that causes least accidental infections and gives the best protection, is pulp vaccine. By this I mean the virus used over most of Western Europe and in England, and notably in Germany, where the statistics on all the points concerned are most complete.

Many methods of treating the pulp have been experimented with. It is not necessary for my purpose to discuss these, and I shall consider only the method now almost universally used, describing it in some detail from the beginning.

Calves are used, generally from 3 to 6 months old, sometimes younger or older. Females are usually preferred on account of the greater cleanliness of bedding, though some operators use young bulls, which they inoculate on the scrotum. The animals are examined with reference to soundness, and are sometimes tested with tuberculin, though this is not necessary, as they are usually killed soon after the operation and can then be examined for disease, before the vaccine is distributed. After being under observation a few days the calves are thoroughly cleaned. Just before the operation, the animal selected having been fastened on a suitable table, the abdomen is shaved and washed with soap and warm water. In some institutions sublimate, carbolic acid or other antiseptic is used. A final washing is done with large quantities of sterlized water and the skin dried with sterilized towels. The operators; in sterilized clothing, observe the usual aseptic precautions. A series of incisions is made in the skin of the abdomen, about an inch apart, extending as far forwards as the navel and laterally to the inner sides of the thighs. Sometimes the anterior abdomen, and even the side and back of the body have been used, but the thicker skin in these parts interferes with the best results. If more than slight bleeding follows the incisions it is checked by pressure with sterilized towels. The "seed" vaccine is then spread over the prepared surface with a spatula and allowed to dry. The seed is of various kinds. Sometimes it is bovine virus, selected with care from well-developed vesicles and of tested bacterial purity. Sometimes it is selected humanized vaccine, sometimes material derived more or less remotely from human variola. Often the makers either do not know, or are unwilling to state, the source and nature of the seed, and often misrepresentation has occurred. It is clear that in order to make an accurate study of the effects of vaccination the history of the material used is essential.

Dressings of various kinds have been used to protect the site of operation, but usually they are not considered necessary. The animals are kept in clean stalls, and carefully observed until the time for removal of the material, between the fourth and sixth days. The vesicles are then of fairly good size, but should not show evidences of suppuration. The calf is again fastened on the table, the abdomen thoroughly scrubbed with soap and warm water, rubbed by hand, and finally washed with sterilized water and dried. This removes the superficial dried epidermic scabs, and does not break the vesicles. For the removal of the pulp the common method is to scrape each row of vesicles with a large curette, though it is said that some still use the forceps to clamp the bases. The pulp is then made homogeneous by grinding, mixed with 50 per cent glycerine, and kept for several weeks to "ripen."

Up to the early 80's pulp was used according to the earlier methods, but after that great activity was displayed in treating pulp with various antiseptics, the details reminding one of the complicated antiseptic dressings used in general surgery at the same period, but since 1891 the use of glycerinated lymph has been general. The addition of glycerine to vaccine virus is much older. Cheyne employed it as early as 1850 to keep lymph fluid; Mueller in 1866 to increase the bulk; Warlomont patented a method in 1882, and there are dozens of references to its use before him. But Copeman, by a series of careful investigations, showed that glycerinated pulp lost some of the bacteria it originally contained, and that they might even disappear completely at a time when the specific virus was still unimpaired in strength, and since then the method has been adopted by the leading vaccine institutions with little or no modification. Drying the pulp or lymph has a similar action on the bacteria, but glycerine has other advantages, one of the most important being the facility with which tests can be made on the glycerinated pulp, rendered fairly uniform by mixing in special apparatus.

The tenacity of life of the specific germs has long been known to vary much, even under conditions apparently similar. In the glycerine preparations this is also true, but the real state is easy to fix by experiment in any specimen. It has been shown that glycerinated vaccine may be effective as long as a year after removal. Though the usual dilution is slight, from half to several times the weight of pulp being added in 50 per cent sterilized glycerine, dilutions of 1 to 2000 will give good results if carefully used. By the present method one calf will furnish from several hundred to several thousand portions of vaccine, three to four thousand being not unusual, and perfect vaccination has been obtained from calves giving as much as 15,000 portions.

Copeman has summarized the advantages of glycerinated vaccine, and I quote from him the following:

"1. Great increase in quantity can be obtained without any consequent deterioration in quality, the percentage of insertion success following on its use being equal to that obtained with perfectly active fresh lymph.

"2. It does not dry up rapidly, as does unglycerinated lymph, thus simplifying the process of vaccination.

"3. It does not coagulate, so that it never becomes necessary to discard a tube on this account.

"4. It can be produced absolutely free from the various streptococci and staphylococci which are usually to be found in untreated calf lymph, and which are, under certain circumstances, liable to occasion suppuration.

"5. The streptococcus of erysipelas is rapidly killed out by the germicidal action of the glycerine. The danger of 'late' erysipelas is diminished by reason of there being no necessity to open the mature vesicle for the purpose of obtaining lymph.

"6. The bacteriological purity and clinical activity of large quantities of the lymph can be readily tested prior to distribution."

But no one who knows the subject claims perfection for glycerinated virus. Many efforts to improve on it have been made, by using other germicides, and many more will doubtless be made, until something still more satisfactory can be discovered. In the meantime it is necessary for all who have to use vaccine to know just what can be expected with the present methods.

The Vaccine Lesions.

Let us now examine some of the peculiarities of the vaccine lesions. From the beginning it has been recognized that the vaccine pock presents peculiarities by which it can be distinguished from all other skin lesions, and especially from smallpox, varioloid and chicken-pox; and by which one can form some opinion as to the quality of the change produced in the organism by vaccination. In his first publication, Jenner gave some pictures that have always been accepted as of the greatest value. All of Jenner's contemporaries admitted the fidelity of the illustrations, and Cuff, who colored them, and who made others for later writers, insisted on their accuracy after he had seen many hundreds of lesions. I show lantern slides of these plates, viz.: The original cow-pox vesicle on the hand of Sarah Nelmes; a vesicle, the second remove from horse-pox; a vesicle in a late stage, the second remove from a vesicle on a cow, casually derived from horse-pox; a vesicle on the 9th day, from virus taken from the subject of the preceding. While these figures are very instructive, Jenner was justly criticised because he did not give a complete description, with illustrations, of the whole course of the disease. He made good the deficiency in 1801, when he published a set of illustrations by Cuff, which I also show. In the meantime Aikin, in England, and Ballhorn and Stromeyer, in Germany, had published illustrations, and these were followed by many others more or less perfectly executed. Waterhouse had an illustration made showing the appearance of the vesicle in the negro, an important aid in the development of vaccination in America.

I show next a copy of Sacco's illustration of cow-pox on the udder of a cow (after Rayer). Pfeiffer is probably right in thinking this was an inoculated cow-pox, not spontaneous, this belief being based on the distribution of the lesions. The vesicles are larger than those in trade vaccination. The next slides, Rayer's own pictures of the vaccine vesicle, are also of interest, on account of the general accuracy of Rayer's illustrations of skin lesions, and the influence the writer exerted upon medicine. I show also his pictures of atypical vaccination. Not less interesting are John D. Fisher's pictures, taken as they were from what were considered typical vesicles by men who remembered the earliest days of vaccination. The next series is that of Kirtland, made in 1802, and interesting because it shows the course of inoculated variola with that of vaccination at corresponding dates, but as it was not published until 1896 it did not affect the development of vaccination. Another valuable picture, historically, is that of Bousquet, showing the effects of recent virus from the cow-pox case of

1836, at Passy, compared with the old virus then used in Paris.

Variations in the details and course of the vesicle have always been recognized as likely to occur, even with perfectly good virus, but on the other hand, marked departures in size, shape and course have always been considered as throwing the gravest doubt on the quality and also on the consequent immunity. Jenner insisted on the necessity of repeating vaccination until a perfect result was obtained. Recently, some doubt has been thrown on the essential nature of the areola, especially by makers of vaccine, and it might readily be supposed that this will not form after the use of virus of great bacterial purity. But I do not think we can abandon even this part of the local phenomena of vaccinia. In countries where most pains are taken to get good vaccine, and where its results are carefully followed and recorded, the areola is usually well-developed. I show some slides taken from cases inoculated by myself with American glycerinated virus of fair bacterial purity, but rather weak specific power, with well-developed areolæ. Incidentally, let me call attention to the method of inoculation, by single incisions, of which I shall speak later. The next and last picture I consider of great importance. It is from a photograph, and shows two lesions. These have dark roundish scabs with irregular surfaces, measuring 6 by 8 and 7 by 8 mm. respectively. Around each scab is a ring-shaped vesicle, from 1½ to 3 mm. wide. There is no distinct areola, but an unusally deep-looking narrow zone of redness and swelling, very unsymmetrically placed, strongly suggesting local infection. This photograph has been widely reproduced in advertisements as a representation of typical vaccine lesions. It differs radically from anything hitherto accepted as a typical lesion, and I shall have to speak of it later. It may serve to introduce the next division of my subject.

Some Aspects of American Vaccine Virus.

I must say at the outset that I do not intend to speak of all makes or makers of vaccine in the United States, but only of certain characteristics that I have found among a few rather conspicuous firms.

It might be supposed that makers of vaccine virus would not sell inferior preparations. Experience shows that this is not so. Dr. Rosenau, of the U. S. Public Health and Marine Hospital Service, who has examined virus for a long period, has shown that practically all the vaccine virus sold in this country has an unnecessarily large bacterial contamination, and although his observations show that improvements have taken place since he began his work, the results are still far from satisfactory. Rosenau charitably attributes the poor quality of the vaccine in part to over-confidence in the germicidal power of glycerine on the part of the makers. This, however, while charitable, is not altogether just. The makers had access to the literature, from which the actual capacity of glycerine to purify vaccine could have been obtained. Besides, the makers, particularly those I have in mind, made the most positive statements of purity, not only in advertisements, where such words as "aseptic" might have had a Pickwickian sense, but also in private correspondence, at the very time the virus, according to Rosenau's examinations, was very bad. It must be remembered that high bacterial contamination does not necessarily indicate dangerous infective possibility, but on the other hand it is believed by many that such an excess has a relation with the frequent secondary infections that occur from such virus. Then, too, the remarkable development of tetanus following vaccination, of two years ago, has been ascribed by MacFarland, long connected with the production of vaccine, partly at least to contaminated virus. Another explanation for the impurity of the virus is that sudden calls for large quantities compel the makers to put on the market "unripe" vaccine. In the present unregulated state of vaccination such demands are unavoidable. Systematic vaccination would do away with it. As it is now it would seem that policy, if not honesty, would lead the makers to declare the imperfection of the virus, just as some honest boards of health, unable to furnish pure water to cities, notify citizens when the contamination reaches a dangerous degree. Or, to take a more commercial comparison, large demand does not excuse a butcher who for a similar reason sells spoiled meat.

The purity of American vaccine is not always as perfect as it should be; how is it about the specific power, or the capacity to confer immunity against small-pox? Much of it is seriously lacking in specific power. Some makers not only admit, but advertise as a point of excellence, that their vaccine does not produce an eruption. While they do not state in advertisements that scars are not left, I have heard the scientific manager of one large firm assert before a medical society that a scar is not necessary. Not only is there no proof of this, but, on the contrary, all the evidence we have goes to show that a certain scar, not too large, not too deep, and quite different from the scar following a slough or a phlegmon, is an essential part of the result of efficient vaccination. Another manager admitted to me that his firm aimed at getting the mildest possible result from vaccination. This they did, as my observations show, by reducing the specific action, for bacterial contamination was quite marked in many points and tubes I saw in use.

Weak specific action has an important bearing on the practical use of vaccination. With the best vaccine we expect to produce immunity lasting for several years, if not, as was once hoped, for a lifetime. Though small-pox, even fatal small-pox, may occur in some persons so vaccinated, yet the general resistance will be high. With less effective virus the immunity is shorter, from a few weeks to a few months, and on the whole very imperfect. At first glance it may seem that vaccine giving protection for even a month would be good enough, but more careful examination seriously alters the matter. If for no other reason, the production of a wound every few weeks would be not only dangerous, but would be more intolerable than the fear of small-pox itself. Moreover, vaccine that gives an abortive vesicle, indicating short duration of immunity, is often very slow in taking, up to a month in one make, by the admission of one of the managers of the firm. But such vaccine would be useless in the face of actual danger, as has occurred so often in the last five years, and as is likely to occur, suddenly, many times in future before our laws are perfected.

Along with indifference to the production of pure and efficient vaccine, some of the makers of that material exert a positive influence for harm as extensive as it is insidious. In the advertising pages of scores of journals, and in countless circulars, not only are the advantages of the wares set forth in the usual language of advertisements, but questions of technic, of pathology and treatment are stated with impressive assurance. The photograph I showed illustrates some of these features. It is said to have been taken on the 8th day, but instead of showing the smooth umbilicated vesicle characteristic of that time, it shows a poorly developed vesicle surrounding a large dense scab. This is not the scab from drying of the contents of the vesicle, but is the result of necrosis of the skin, caused by extensive and deep scraping, part of the technic recommended by the firm. This method, if not original with makers of vaccine, owes its present vogue, I think, to the writings and pictures published by such firms, and to the demonstrations made by representatives of the firms, sometimes men of no medical training whatever. It is based upon a method formerly much used by physicians, and still recommended in some text-books, but according to the original method the denudation is very superficial, the epidermis is regenerated within a few hours, and the vaccine lesion goes on undisturbed by a necrotic mass over its place of inoculation. But the early scab is undesirable for other reasons than the very good one just mentioned. It favors accidental infection by rubbing with the nails or clothing, owing to its irritating qualities; it furnishes a good nidus for germs either originally in the skin, or introduced at the operation or later, and especially for those of tetanus. Many vaccine wounds have been so severe that boards of health have found it necessary to protest against them, and the Board of Health of Chicago has taken the pains to print a diagram one-eighth inch square as the largest abrasion compatible with safety. It would be much better to prohibit such an operation entirely, as has been the law in Germany for several years. As my own photographs show, clean superficial incisions will permit the virus to take, if it is potent, and it is obvious that if such incisions do not heal by primary union, there is at least but little irritating and septic material in them.

The history of the photograph with the hard scab also illustrates other aspects of the vaccine trade, viz., the possibility of lack of special knowledge of vaccinia on the part of the makers, and the differences of interest of the so-called biologic department and the counting-room. The gentleman in charge of the former was not aware of the difference between a depression caused by an early scab, and the characteristic umbilication of the genuine vesicle. In a letter replying to my criticism of the picture he wrote: "I saw these vaccinations just before they were photographed, and, in my opinion, they are very nearly typical for the age of the lesions." He also asserted that his firm had never sent out any other pictures of vaccine lesions, and quoted employees of the publication department to prove the statement, though I was able to show him a picture sent out as a circular by his firm, in which a group of abortive conoidal vesicles was reproduced as an illustration of the successful use of the virus.

I mention this experience as an evidence of the need of some better arrangements for the production of vaccine virus than we now possess, an arrangement by which the material would become less a commodity to be turned out according to the inclinations of those who know nothing and care little for any other than its selling qualities, and more the subject of careful elaboration and well-directed effort at improvement. Copeman makes the interesting statement that in the vaccine institutions he visited in Europe researches were being made tending to improve the quality of vaccine. Medical literature bears witness to the scientific activity of these institutions, but in this country the only originality exhibited is limited to details of packing.

It is too often forgotten that vaccination is a public rather than a private benefit. Its real object is not merely to prevent sickness or death in individuals, but to prevent epidemics with all their numerous and widespread consequences. This is the reason why some countries have adopted general vaccination, and the reason why in this country, without a well-planned regulation, measures are adopted in times of danger that aim at compulsory and general vaccination, but for various reasons often fail.

If people voluntarily adopt general vaccination, they are not likely to continue the practice unless the operation is reasonably mild and safe, and the protection fairly certain. As more or less compulsory vaccination is likely to be necessary for a long time to come, it would seem essential that the power compelling the operation should guarantee the purity of material and the safety of the operation.

For this, either public manufacture or public inspection are necessary. Inspection as carried out for the last two years under the Public Health and Marine Hospital Service has done some good, but as the results are published without names much of the value of the examinations is lost, and no test of specific activity is attempted. It is often said that such control is impossible under our system of government, but this objection is more theoretical than real. If the general government can furnish pure seed to farmers, and the separate States regulate the sale of oleomargarine, the inspection of oil, salt, etc., or the sale of alcoholics and tobacco, vaccine could easily be put under public control, provided, of course, that the wishes of the people were not thwarted by the unseen but powerful influence of lobbies supported by those who prefer to keep the industry in their own hands. The details of such public control are beyond the scope of this paper, which aims rather at exciting an interest in the practice of vaccination and its accurate and careful study.

CONCERNING THE SINUS FRONTALES IN MAN WITH OBSERVATIONS UPON THEM IN SOME OTHER MAMMALIAN SKULLS.

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(From the Hearst Anatomical Laboratory of the University of California.)

A review of the literature suggests the necessity of a more complete description of the sinus frontales with some revision of the nomenclature according to their developmental characteristics, as well as a complete study of their architecture. The writer accordingly took Dr. Flint's suggestion to make a series of metallic injections of these cavities in order to reveal in positive form the normal negative outlines of the sinuses. Since students rarely obtain a stereoscopic concept of the pneumatic spaces contributing so markedly to the shape of the human cranium, an employment of the method by classes engaged in routine dissections is urged. In this laboratory it is found that students gain a much clearer idea of the cavities when they are studied by means of lead casts.

As will be seen by reference to the illustrations, two kinds of technique were utilized in gathering data for this paper, namely, chiselling and casting. The chisel calls for time and some delicacy of manipulation to get good results, but casting is simple, rapid, and seems by far the best method, inasmuch as the lead mold positively expresses the negative sinus. Following is an outline of the casting method:

When students have completed the dissections of the external face and cranium, a sagittal section of the head is made corresponding to the median line. While one or the other sinus frequently overlaps the median plane, the septum between them is commonly complete; accordingly it occasionally happens that the sections open only one sinus, and a pour-hole into the other must be provided by drilling through the intact septum. To prevent the metal escaping from the sinus by way of the infundibulum ethmoidale, the hiatus semilunaris is exposed and plugged with moist clay. In a melting pot over a circular gas burner, lead is raised to a temperature of brisk oxidation, as metal of a lower temperature often solidifies before reaching the utmost limits of the cavity. With these precautions the metal is directed into the sinus with a pouring ladle. It must, however, be poured slowly and in a thin stream, for should it enter rapidly and in a large mass, air is often retained in the sinus in quantities sufficient to ruin the cast. After allowing the lead to cool thoroughly the material is returned to the student for further dissection. Under the supervision of an instructor, he carefully removes the molds. They are then marked with the body number, making it possible at any time to obtain collateral information concerning the individual by consulting the records in the preparation room. The casts have rough surfaces due to generation of gas by the melted lead coming in contact with organic tissue in the cavities. Furthermore, the metal contracts slightly while cooling, but in the main the molds approximate quite exactly the sinuses in which they are made.

This study is based upon examination of twenty-one adult male subjects, in age ranging from twenty-five to sixty years. The molds of all the sinuses changed from their normal state by pathological processes were rejected.

The cavities are said to be generally smaller in the female than in the male. Owen[1] has observed that the sinuses of Europeans are larger than in some other tribes. He states that they are imperfectly developed among the native Australians, and in consequence this deficiency engenders a want of resonance to the voice. In opposition to this, Macalister states that the sinuses are very large in Australian crania,[2] and Hilton finds them quite extensive in the skull of an African aborigine.[3] The latter, however, made but a single observation, and it is possible, of course, that his specimen might have been an unusual one.

Sufficient attention has not been called either to the importance of symmetry in the architecture of living forms, to its significance, or to the means by which it becomes one of the most striking characteristics of all the higher forms of organic life. It is suggestive, however, that all structures in the body are at some period in the life-history of the organism either completely or partially symmetrical—that is to say, form either complete mirror changes of each other, or may be divided by a median plane into halves which are enanteomorphic. In this connection it is noteworthy, therefore, that the sinus frontales vary in respect to symmetry more than any other paired structures in the human body. This is noted not only with reference to the deflection of the septum sinuum frontalium but also in other characteristics of sinuses in the same skull.

The sinuses form two cavities in the os frontale, situated dorsad of the arcus superciliaris and cephalad of the orbita, displacing the spongy bone between the inner and outer tables. They communicate with the meatus nasi medius by means of an osseous tube, the infundibulum ethmoidale, and are lined with a continuation of the nasal mucous membrane. Their position divides them into two parts, the pars frontalis, the portion of the sinus in the squama, and the pars orbitalis, the portion in the pars orbitalis ossis frontalis. Both frontal parts are shown in Fig. 5, *P. F. D.* and *P. F. S.* The orbital parts are shown in the same figure, *P. O. D.* and *P. O. S.* Between the partes frontales is a perforate or imperforate partition of bone, leaning to one side or the other, the septum sinuum frontalium (Fig. 5, *s. s. f.*). The frontal and orbital parts of the cavity are separated from each other in varying degrees by a partition of bone called the septum interpartes (Fig. 5, *s. i. d.*). The cavities are also subdivided by bony trabeculae called septa laterales when in the pars frontalis (Fig. 5, *s. l. s.*), and septa dorsales when in the pars orbitalis (Fig. 5, *s. d. s.*). The lateral limits of the sinuses are ordinarily distant from each other about seven centimeters. They reach cephalad into the squama about three centimeters, and the diameter of a sinus from the most ventral point of the pars frontalis to the most dorsal one of the pars orbitalis is about two and a half centimeters. These figures of course represent the average of the twenty-one specimens used for this study. The pars frontalis of one sinus usually overlaps the median line and encroaches upon the territory of the other. This unequal development is responsible for the deflection of the septum sinuum frontalium. The two cavities always show a marked difference in outline and capacity, as is readily seen upon inspection of the casts represented in Fig. 5.

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[1] Owen, Ours: Circle of Sciences, p. 167. Quoted by Humphry. A Treatise on the Human Skeleton, etc. G. M. Humphry. Macmillan & Co., London, 1858.

[2] A Text Book of Human Anatomy, etc. A. Macalister. P. Blakiston Son & Co.

[3] Hilton On the Cranium, p. 13. Quoted by Humphrey. A Treatise on the Human Skeleton, etc. G. M. Humphry. Macmillan & Co., London, 1858.

The sinus frontalis may be absent throughout life. This condition was found once in the skull of an old adult and the usual superciliary eminences were entirely wanting of both sides.[4] The extremes in size are pictured in Figs. 3 and 4, the former showing the largest, the latter the smallest casts in the series.

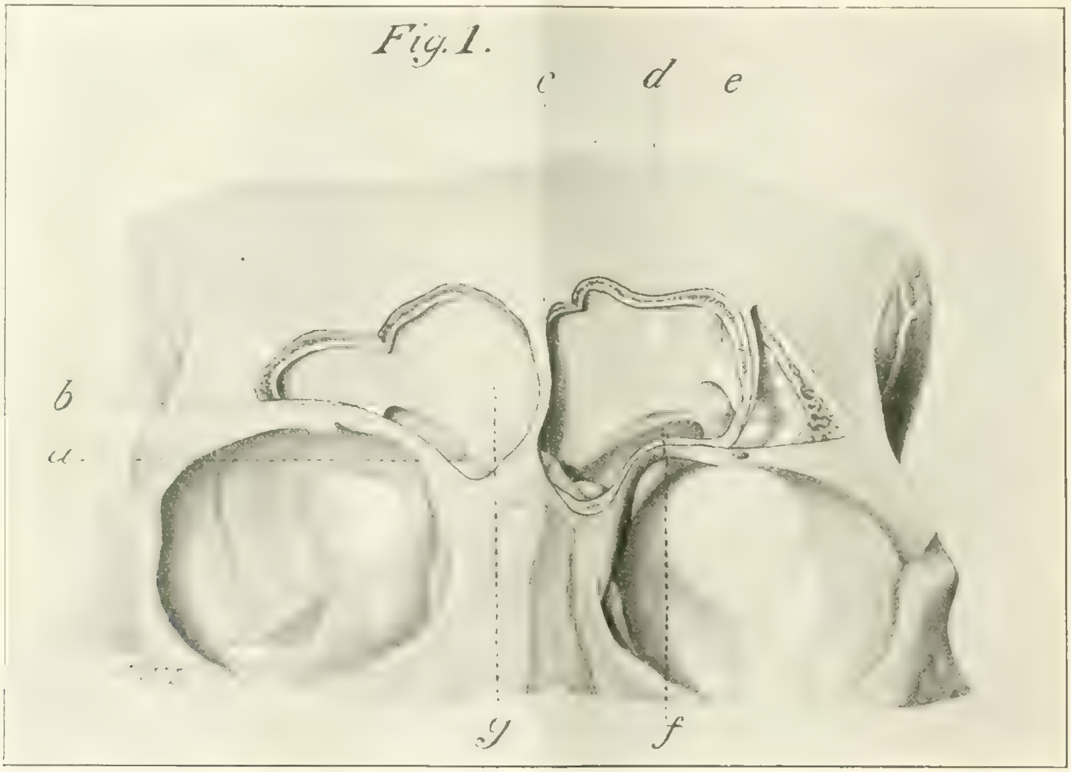

FIGURE 1. Human Sinus Frontalis. In this case the arcus superciliaris on each side was equally developed, notwithstanding the difference in the size of the sinuses. The median septum approximates the mid-line more clearly than is usually the case.

a—Summit of Bulla ethmoidalis dextra. Its fellow is opposite occupying a slightly lower level.

b—Septum interpartes.

c—A strip of the outer table of the skull and a portion of diploë above the septum sinuum frontalium. The latter is intact and very thin. This septum more nearly approximates the median line than is usually the case.

d—Linear elevation of the dorsal wall indicating a poorly developed septum lateralis.

e—Septum lateralis.

f—Pars orbitalis sin.

g—Pars orbitalis dex.

Contrary to the statement of Sappey,[5] examination of the arcus superciliaris develops no precise information concerning the size of the sinus beyond. The arcus may be larger or smaller than the sinus. In the majority of cases, it is quite true that a large superciliary prominence indicates a large cavity behind it and also the reverse, but the presence of an arcus is no guarantee of a sinus in the squama ossis frontalis. One old individual of the series possessed strongly fashioned eminences above the orbits, but had sinuses extending only into the orbital roofs. Casts of these appear in Fig. 4.

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[4] A series of sagittal sections found this os frontale of an unusual construction; it was thin throughout, the diploë included between the outer and inner tables was reduced to a thin line.

[5] Traité d'Anatomie Descriptive, Ph. C. Sappey, Vol. I, p. 264. Paris, 1888.

Between the sinuses is the septum sinuum frontalium. Proportionate to their extent into the squama, this septum is contracted in breadth and increased in length. It seldom approximates the median line, a fact due to the unequal size of the cavities. When the two sinuses communicate the septum may be perforated at any point in its extent. Usually, however, if not intact, the opening cuts through its caudal extremity. Out of twenty pairs the right sinus was largest in thirteen, the left one in three, and the remaining four were about equal.

Fig. 2.

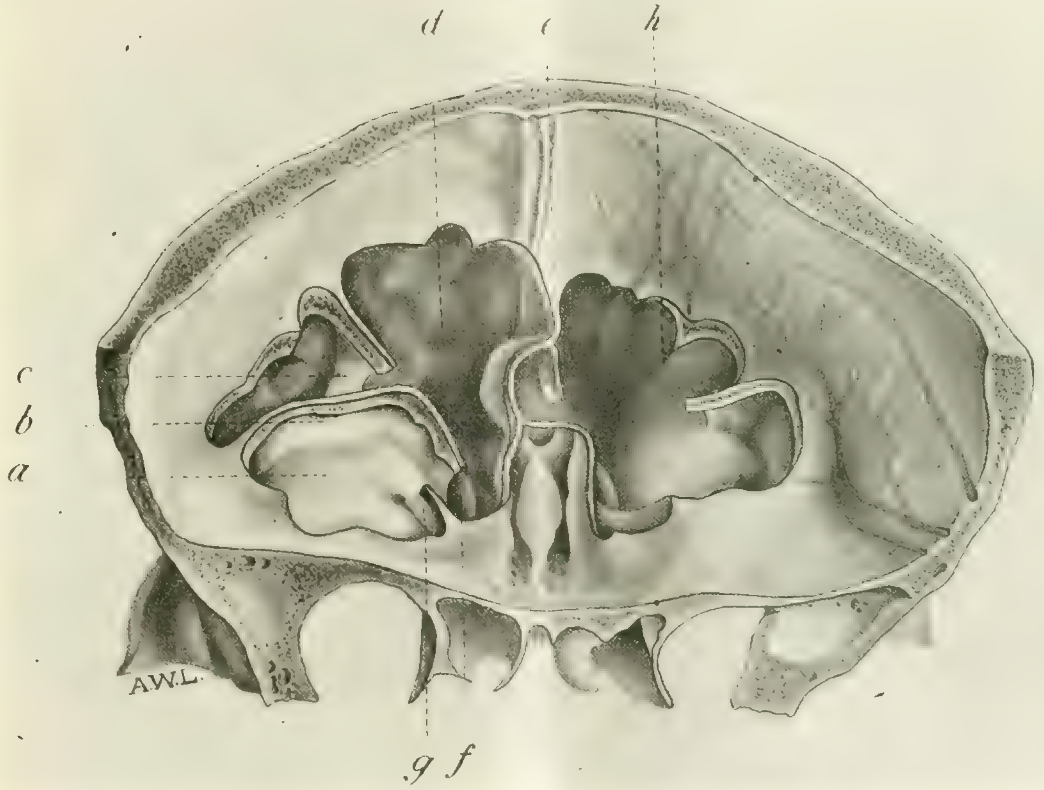

Figure 2.—Nearly all of the bone dorsad of the sinuses is removed. The left sinus is considerably the largest.

a—Pars orbitalis sin.

b—Long, tortuous and thin septum interpartes sin. Its fellow is more ventrally placed, is shorter, thicker and stands in one plane.

c—Septum lateralis sin.

d—Pars frontalis sin.

e—A strip of the inner table of the skull and a trace of diploë corresponding to the septum sinuum frontalium, although the latter is very thin. In this specimen the septum is intact and is in its characteristic, deflected position, but the medial chamber of the right sinus has caused an unusual division of the septum, one arm being continuous with the medial walls of the cavities and the other arm ending by a free, caudal border in the pars frontalis dex.

f.—Bulla ethmoidalis sin.

g.—Septum dorsalis sin. It is longer and thinner than usual. Opposite is seen another septum dorsalis stretching between the dorsal and medial walls of the pars orbitalis dex. and has a free, falciform, cephalic border.

h.—Linear elevation of ventral wall and is all that remains of a one-time septum lateralis.

Since in the process of their evolution the sinus frontales extend into both the squama and pars orbitalis ossis frontalis, it may be convenient to classify them according to their position; any pair may consist of partes orbitales, or partes frontales, but the latter condition is much more common. If the sinus of one side presents both parts well developed, its mate is usually approximately the same in form. However, when one sinus shows a capacious pars frontalis with only a slight orbital extension, the opposite cavity as a rule will be purely frontal in location.

The pars frontalis is, at times, no more than a slight.

cephalic dilation of the infundibulum ethmoidale, reaching not further than the caudal level of the glabella (Fig. 8, *A*). While again it will be seen passing cephalad to the caudal circumference of the tuber frontale, stretching laterad to the linea temporalis, or even, according to Hajek,[6] excavating the processus zygomaticus and running dorsad to the sutura sphenofrontalis.

Out of nineteen cases where it appeared on both sides the pars frontalis was largest in thirteen. This frontal portion of the sinus (Fig. 1, *g*), whether large or small, is commonly a single chamber, but it consists frequently of a series of unequally-sized pockets, partially separated from each other

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[6] Nebenholen der Nase M. Hajek Leipzig, und Wien

Fig. 3.

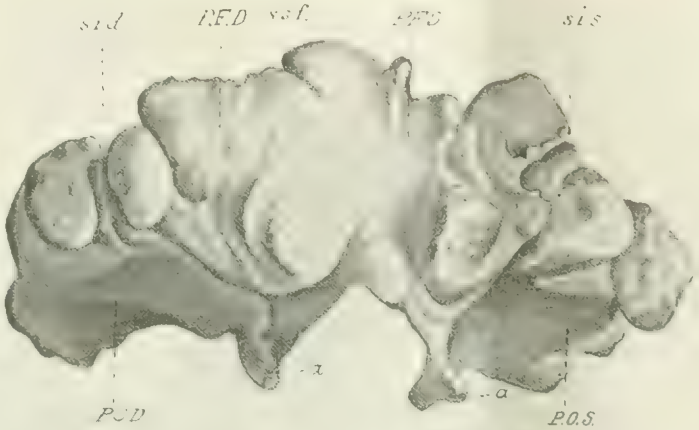

Fig. 4.

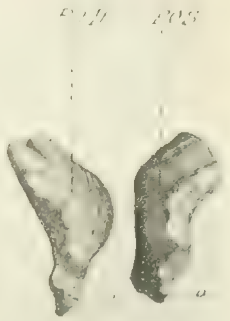

Fig. 5.

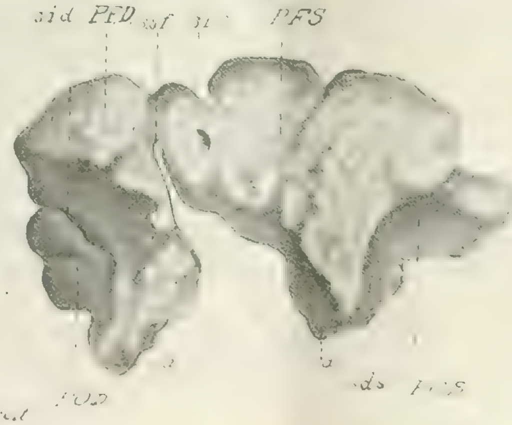

Figure 3.—A Wood's metal cast of a large sinus (natural size).

P. O. D.—Pars Orbitalis Dex.

P. F. D.—Pars Frontalis Dex.

P. O. S.—Pars Orbitalis Sin.

P. F. S.—Pars Frontalis Sin.

s. i. d.—Septum interpartes dex.

s. s. f.—Remains of septum sinuum frontalium.

s. i. s.—Septum interpartes sin.

a.—Metal prolongation into the cephalic end of the infundibulum ethmoidale.

Figure 4.—Lead casts of a small sinus and representing an instance where the sinuses were purely orbital in development (natural size).

P. O. D.—Pars Orbitalis Dex.

P. O. S.—Pars Orbitalis Sin.

a.—Metal prolongation into the cephalic end of the infundibulum ethmoidale.

Figure 5.—Casts of an average pair of sinuses, showing a natural perforation of the septum sinuum frontalium (natural size).

P. O. D.—Pars Orbitalis Dex.

P. F. D.—Pars Frontalis Dex.

P. O. S.—Pars Orbitalis Sin.

P. F. S.—Pars Frontalis Sin.

s. i. d.—Septum interpartes dex.

s. s. f.—Septum sinuum frontalium

s. l. s.—Septum lateralis sin.

s. d. s.—Septum dorsalis sin.

a.—Metal prolongation into the cephalic end of the infundibulum ethmoidale.

by bony septa. These septa laterales (Fig. 1, *e*) are hung from the cephalic junction of the ventral and dorsal wall of the sinus and, before extending far into the sinus, often end in free, falciform borders. Occasionally they are so long that the several chambers are continuous with each other by very small openings. The septa, however, do not always span the intermural space but exist as low lineal elevations, in the majority of instances on the ventral wall (Fig. 2, *h*, and Fig. 1, *d*.). It is the rule for the septa laterales to increase in number with an increase in the lateral extent of the sinus, but the amplitude of the latter, however, bears no definite relation to the presence of the septa. A large cavity may exist without them (Fig. 7, *A*), while a comparatively small one may possess a number. The capacity of a sinus, moreover, does not seem to influence the form of the septa. In a large cavity the one existing partition is often found so thin that light passes through it almost unobstructed, while those of a smaller sinus may be short and thick.

Fig. 6.

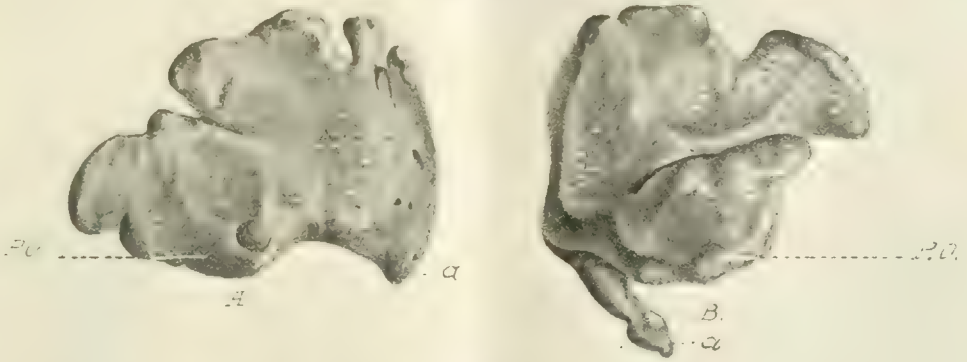

Fig. 7.

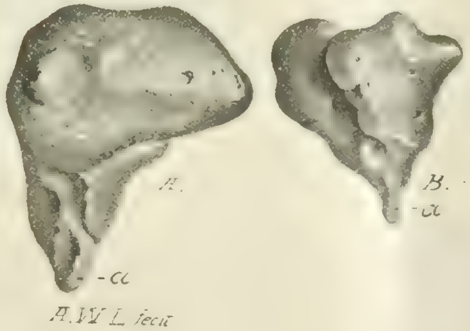

Fig. 8.

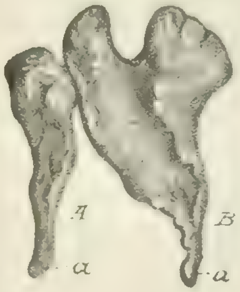

FIGURE 6.—A and B are casts from different subjects (natural size), dorsal view. They illustrate the variation in position of the partes orbitales. P. O. of A shows a left orbital extension proceeding from the lateral portion of the pars frontalis, while P. O. of B is a pars orbitalis dex., resembling an outstretched wing, passing from the medial portion of the pars frontalis. A long septum interpartes partially separated the masses of metal representing the two divisions of the sinus.

FIGURE 7.—A and B are casts from the left sinuses of different subjects (natural size), ventral view. A shows no lateral septum, while B, although a smaller sinus, is nearly bisected with an interval created by a long septum lateralis, indicating that these structures have no direct bearing of the size of the sinus.

FIGURE 8.—A and B are casts from a middle-aged adult (natural size), ventral view, showing one sinus as a simple dilatation of the cephalic end of the infundibulum ethmoidale. The casts A and B are joined by a mass of metal filling an opening in the middle third of the septum sinuum frontalium.

The type of sinus represented by the pars orbitalis alone often exists on one or both sides. This, however, is much less common than the purely frontal type, or a combination of the two. The pars orbitalis is represented at times by a simple, slight, dorsal extension of the pars frontalis, while at others it reaches out over almost the entire orbital roof. In the series, the pars orbitalis existed bilaterally in ten crania, where that of one side showed no marked size difference with its fellow. Out of twenty-six single sinuses, however, presenting a combination of orbital and frontal parts, the latter was most voluminous in twenty-two.

The pars orbitalis (Fig. 2, *d*) usually passes dorsad from the medial portion of the pars frontalis (Fig. 6, *B. P. O.*), nevertheless it might be an extension from the lateral part of the frontal division of the sinus (Fig. 6, A. *P. O.*). At times both parts communicate with each other very freely, but they usually are divided by a septum reaching medially from the lateral limit of the sinus. This septum interpartes (Fig. 2, *b*) may exist in one sinus and be absent on the opposite side, or, as is usually the case, be present in both. In construction it often varies from a long, thin partition to a short, thick one. Like the frontal division, the pars orbitalis may consist of one or many chambers, but its pockets are seldom as large, since the septa forming them are, as a rule, rarely so deep as the septa laterales. The septa dorsales, subdividing the orbital portions of the sinus, are usually, however, short and thick. Generally speaking, they arise from the lateral and dorsal limits of the pars orbitalis, although they may sometimes pass laterally from the median wall.

The sinus frontalis of the ox excavates the frontal, parietal and occipital bones, making a very large chamber between the inner and outer tables which may or may not communicate with its neighbor on the opposite side. The two tables of the cranium are not reinforced by complete bridges spanning the sinus, except around the peripheral portions of the cavity, where thick trabeculæ divide it into small pockets, not comparable in size, however, in size to similar structures in the human skull. The sinus extends up into the horn which near its base is also trabeculated. Dorsad of the horn there is a system of trabeculæ admirably situated for the reinforcement of this part of the skull against strains or shocks imparted through the horns. These also form with the outer table of the skull an eminence for the attachment of the large cervical muscles. That the presence of the sinus in this animal affords some protection against traumatism, is shown by a specimen witth an extensively healed fracture of the outer table over the sinus, while the inner table remains intact. It does not seem possible to subdivide the sinus frontalis in the ox's skull into distinct portions, unless they are named arbitrarily from the bones or regions in which they occur.

Fig. 9.

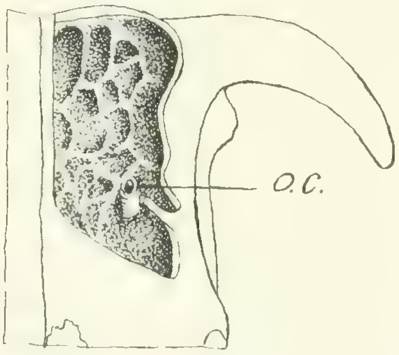

FIGURE 9.—Detail of an illustration from Ellenberg and Baum,[7] showing the immense sinus frontalis of the ox, which excavates the frontal, parietal and occipital bones, as well as the horn.

The frontal sinus in the pig's skull (Fig. 10) excavates the frontal and a portion of the parietal bone. It does not, however, extend into the occipital bone as is the case with the ox. This sinus is usually separated from its neighbor by a complete bony septum somewhat more regularly placed than septum sinuum frontalium in the human cranium, although the partition in the pig may have usually a considerable lateral deflection. This sinus is often subdivided into a pars medialis and a pars lateralis by a septum interpartes which extends anteriorly to a greater or less extent. These two parts, however, do not correspond respectively to the pars frontalis and pars orbitalis of the sinus frontalis in the human cranium. The pars medialis is included between the median and lateral partition and corresponds to the pars frontalis, while the pars lateralis is located between the orbit and the septum interpartes corresponding to the pars orbitalis of the human sinus frontalis. The two portions of the sinus communicate anteriorly. As in the human and other specimens, the sinus is subdivided around its periphery by a series of small trabeculæ into small pockets. These, however, cannot lend a great deal of additional strength in reinforcing the vault of the cranium, but the septum interpartes (Fig. 10, *c*) reaching from the outer to the inner table and extending forward through the broader part of the sinus contributes a great deal to its struc-

Fig. 10.

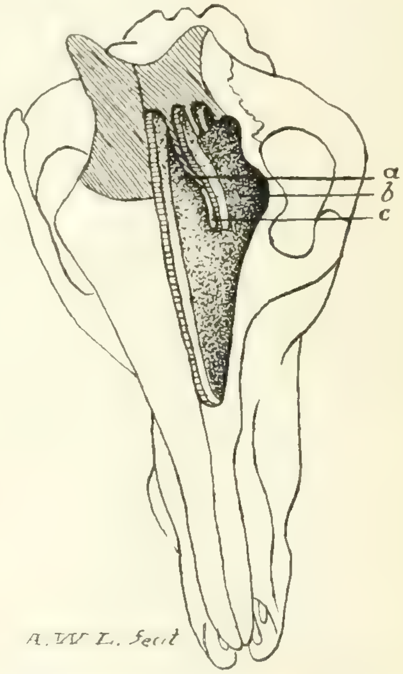

FIGURE 10.—A preparation of an adult pig's skull viewed slightly in perspective. The area shaded with diagonal lines represents a portion of bone removed to exhibit the sinus which excavates a position in the frontal and parietal bones. Here the cavity is differentiated into a pars medialis (*a*) and a pars lateralis (*b*) by a long septum interpartes (*c*).

[7] Handbuch der Vergleichenden Anatomie der Hausthiere. Ellenberg u. Baum, p. 102, Berlin, 1900.

tural strength. The sinus frontalis in the sheep is limited to the ventral and lateral portions of the ossis frontalis. Its depth in the maximum is from 0.7 to 1.5 centimeters. Like the sinus in the pig's skull, it is subdivided into two portions by a septum interpartes and the trabeculæ around the periphery of the sinus are much more developed, exaggerating the sacculation of the sinus to even a greater degree than is shown in Fig. 11.

In the dog the frontal sinus (Fig. 12) shows an irregularly spherical or ovoid cavity in the frontal bone, usually completely separated from its mate by the septum. No trabeculæ bridging the tables are found in this skull and those around the periphery of the sinus are only developed to the extent of slight ridges, thus causing a slight sacculation of the periphery of the sinus. In the skull of the cat (Fig. 13) the sinuses are limited to the frontal bone and are completely separated from each other by the septum sinuum frontalium. This cavity can often be divided into the pars frontalis and the pars orbitalis by a septum interpartes, the orbital portion extending lateralward out into the orbital process of the frontal bone. With the exception of this septum, there are no trabeculæ save those indicated by mere ridges to interrupt further the regular outline of the sinus. In monkeys there is no sinus frontalis present, notwithstanding the well-developed arcus superciliaris. There are, however, a large number of dilated bony cells which occupy a similar position to the sinus frontalis as it is found in other animals. These rarefied bone cells take the place of the sinus and probably communicate with each other and the nasal meatus, although injections to prove this point were not made. In horned animals trabeculæ are arranged so as to provide not only for the strength of the sinus and the protection of the cerebrum, but also as a reinforcement against stress applied to the skull through the horns. No gradual increase or decrease in complexity can be followed through the animal series, the sinus seeming to adapt itself in each species toward the architecture of the skull to the end that it affords at the same time lightness and strength.

Fig. 11.

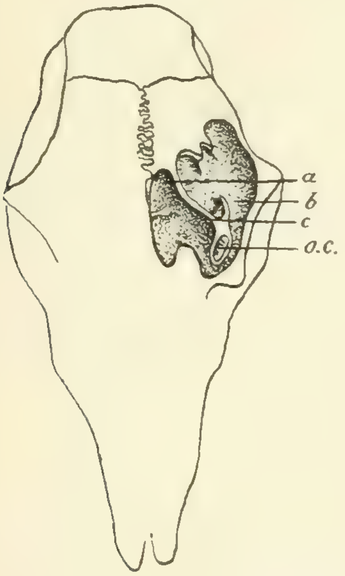

Figure 11.—A preparation of an adult sheep's skull, where the sinus frontalis is confined to the frontal bone.

a—Pars medialis.

b—Pars lateralis.

c—Septum interpartes.

The latter in this animal has the additional function of lending support to the osseous tube O. C., which transmits into the superciliary vessels and nerve.

Fig. 12.

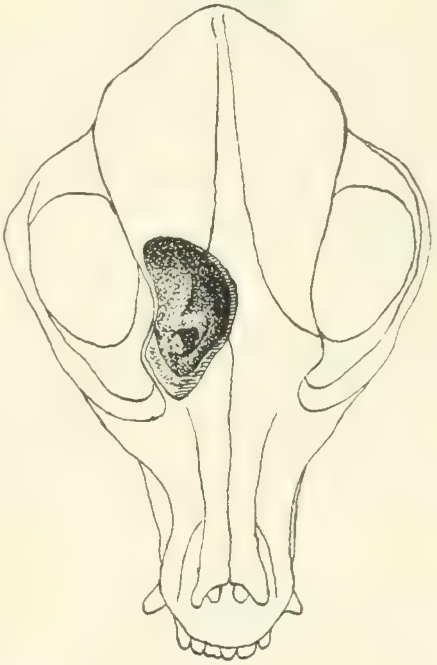

Figure 12.—A preparation of an adult male dog's skull, and shows the sinus entirely within the frontal bone.

It has been suggested that the frontal sinuses are being eliminated from the vertebrate skeleton by a process of evolution, owing to their occasional absence in otherwise normal human crania, their irregularity in form, extent and capacity, as well as their extreme asymmetry. But a comparison of the sinuses in a series of mammals shows no diminution in their size corresponding to the position of the species in the animal scale. Moreover, the extreme modification presented by the sinuses in monkeys also seems to argue against the plausibility of the suggestion.

Inspection of a comparative table of the relation of brain weight to body weight in the series of mammals compiled by Leurent and Gretiolet reveals the following facts:

For example, in the horse and pig the ratio of brain weight to body weight is respectively 1 to 582 and 1 to 481, that is to say, the proportion is much smaller in the pig than in the horse and yet the former has the largest frontal sinus. It appears from these two instances, which can also be amplified by others in the table, that there is no distinct relation between brain weight in its relation to body weight and the sinus frontalis. This also appears to be the case in reference to the relation between the cranial capacity and the size of the skull, for monkeys, which next to man have the highest relative cranial capacity, possess only a modified frontal sinus as the tissue beneath the well-developed superciliary arches consists simply of dilated pneumatic cells.

Fig. 13.

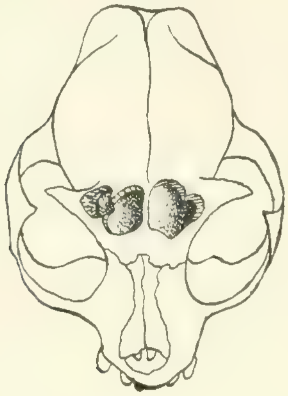

FIGURE 13.—A preparation of an adult female cat's skull with the sinuses situated in the frontal bones.

Fig. 14.

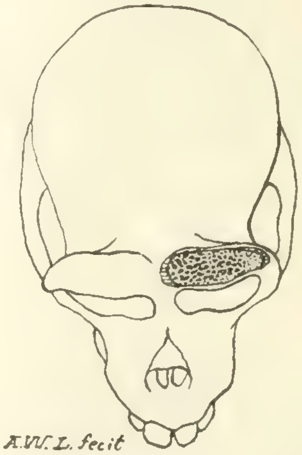

FIGURE 14.—A preparation of an adult male monkey's skull (species unknown). No sinus exists in the usual form. The arcus superciliaris sin. has been cut and shows the sinus, consisting of dilated pneumatic spaces.

A MODIFIED NOCHT'S STAIN.

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The numerous methods of blood staining and the many staining fluids described during the last seven years have had as their objects to be attained the doing away with separate fixation and the development of the malarial "chromatin-staining" material.

The stains described by Romanowsky, Ziemann, Nocht (1), Jenner (2), Goldhorn (3), Leishman (6), Michaelis (7), Reuter (8), Willebrand (9), Wright (10), and Schegoleff (11) possess at least one of these qualities, and Leishman's and Wright's possess both of them. None of these methods, however, gives constantly and without fail the clear, intense staining obtained by employing Nocht's principle of mixing the three solutions of eosin, alkalinized-methylene-blue, and methylene blue. Nocht (12) pointed out that the essential staining element of the Romanowsky and Ziemann methods is a new staining material, which he designated as "red from methylene blue" (Michaelis' (13) "methylen-azur," or "azur-blau"), which is formed in all alkaline-methylene-blue solutions.

While using Nocht's methods according to the directions given by Lazier (4) and by Ewing (5), the possibility of preparing a Nocht's solution with methylic alcohol suggested itself—a combination of Nocht's and Jenner's methods.

After several trials such a solution was obtained, but little or no differentiation of leucocyte granules and no "chromatin-staining" were obtained until Leishman's publication suggested the method of differentiation by diluting the staining fluid with distilled water.

The stain-powder is made as follows from the dry, powdered water-soluble yellow eosin and the dry, powdered Ehrlich's rectified methylene blue (or medicinal methylene blue):

A. Eosin solution ....1% aqueous.
B. Alkaline-methylene-blue solution..1%
C. Methylene blue solution..........1% aqueous.

B (Nocht, 14) is freshly prepared by adding to a warm 1% solution of dry, powdered sodium carbonate (Na_2Co_3) 1% of methylene blue powder; heating this mixture over a water-bath for 15 minutes; adding 30 cc. of water for each 100 cc. of original fluid to replace loss by evaporation; and heating a second time over water-bath for 15 minutes (to make up one lot of stain 200 cc. of this solution B should be prepared). This warm alkaline-methylene-blue solution is poured off from the gummy residue, partially neutralized with 5-6 cc. of 12½% acetic acid, and mixed with solutions A and C, as follows:

Distilled water	1000 cc.
Eosin sol. A	100 cc.
Alkaline-methylene-blue sol. B	200 cc.
Methylene-blue sol. C	70-80 cc.

If 70 cc. of solution C is not a sufficient quantity to produce a fine precipitate, this solution (C) is added until the precipitation is obtained (70-80 cc. in toto).

This mixture of three solutions is allowed to stand ½ to 1 hour, filtered through one filter, the residue allowed to dry in the air for 24-36 hours, and this dry residue is dissolved in Merck's pure methylic-alcohol.

From the quantities given above one obtains usually 0.7 to 0.9 gramme of dry, brittle residue, and 0.3 gramme of this dry residue in 100 cc. of methylic-alcohol results in the satisfactory staining solution. The residue is soluble with difficulty and must be rubbed well in a mortar with pestle to obtain solution.

To use the stain no previous fixation is required. The dried blood smears are flooded with the staining-solution for 1 minute; the solution is then diluted with distilled water (5-7 drops for ⅞-inch cover-slip) and this diluted stain allowed to act for 5 minutes; the specimen is washed thoroughly with distilled water, care being taken to clean off with the fingers the negative side of the glass upon which a precipitate collects; blotted with filter-paper; mounted in balsam.

The colors of nuclear material, granules, plates, red cells, malarial parasites, are similar to those found in specimens stained by Nocht's method.

Bottles of the staining fluid two years old retain their fixing and staining properties, provided the stain is always poured from the bottle and pipettes are not used, for slight changes in reaction of the fluid destroy the staining properties. Stained specimens do not fade, but are found well stained after a period of two years. Specimens several weeks old may not stain well; specimens several months old never stain well; and leukemic specimens rarely stain well after six to eight weeks.

The chromatin material of the malarial parasite stains clearly. The stippling of Schüffner (15) and of Ruge (16) is well shown. All the leucocyte granulations are well differentiated.

The granular-basophilic and polychromatophilic changes in the red cells are well shown. The blood plates stain clearly.

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COMPLICATIONS ARISING FROM FREEING THE URETERS IN THE MORE RADICAL OPERATIONS FOR CARCINOMA CERVICIS UTERI, WITH SPECIAL REFERENCE TO POST-OPERATIVE URETERAL NECROSIS.

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Associated with the advance in all forms of surgery, there arises a new series of complications which must be recognized, remedied and finally avoided. The most serious complication which has been associated with the advance in the operative treatment of carcinoma cervicis uteri has been that of injury to the ureter. Since the opening of the Johns Hopkins Hospital in August, 1889, until January 1, 1904, there have been admitted to the gynecological department of this hospital 10,961 patients. Of these, 8590 have undergone an operation of some sort. There have been 4669 major operations, which term includes all coeliotomies, both abdominal and vaginal, and all operations on the kidney. There have been 31 instances of accidental injury to the ureter, only one of which occurred in a minor operation, a ligation of the ureter in repairing a vesico-vaginal fistula. Of these 31 cases, 19 occurred in hysterectomy for carcinoma of the cervix. Accidental injury to the ureter as a complication associated especially with hysterectomy for carcinoma cervicis uteri becomes very evident when one considers that there have been 19 instances of injury to the ureters in 156 hysterectomies for cancer of the cervix, as compared with only 11 cases in 4513 other major gynecological operations. These injuries have been of various kinds, as ligating, clamping, cauterizing, cutting, and interfering with the blood-supply of the ureter so that necrosis occurred with a resulting uretero-vaginal fistula. Some of these injuries were recognized at the time and repaired, while others were not discovered until afterwards. The cases of accidental ligation and clamping of the ureter have been published.[1]

All who are interested in the operative treatment of carcinoma cervicis uteri recognize that hysterectomy alone effects a cure in but a very small percentage of the cases. The comparison of statistics is very unsatisfactory and misleading. Over a year ago all our cases were reviewed, and we found that only about 12 per cent were free from recurrence at the end of five years, and about 23 per cent at the end of three years. In addition, there had been a primary mortality of 14. + per cent. If 14. + per cent die as a result of the operation, and about 88 per cent of the cases recur within five years after the operation, it is little wonder that cancer of the cervix is looked upon by many as an incurable disease, especially when, in addition, it is considered that in about three-fifths of the patients admitted to this hospital with this disease, the growth had extended beyond operative treatment.

I have studied the relation between the ureters and carcinoma cervicis uteri and these results[2] have been published. In this article the work of Kundrat[3] was reviewed, who studied the parametrium in 80 of Wertheim's cases. He showed that the parametrium was involved in 44 of these cases, and that apparently in 22 of these 44 cases the parametrium had been able to stop the further extension of the disease, as shown by a study of the pelvic lymphatics beyond the parametrium, thus emphasizing the importance of a wide excision of the parametrium. Kundrat also showed that only by the microscope can one diagnose the presence or absence of cancer in the parametrium, as has been emphasized by both Wertheim[4] and myself.[5]

A study of the relation between the ureters and the cervix shows that this varies in different cases and may be altered by physiological and pathological conditions, and also by various steps in gynecological operations. At the point where they enter the parametrium they may be 2 to 3 cm. distant from the cervix, while where the ureters enter the bladder the distance may be less than 5 mm., depending on the position of the uterus in the pelvis, it therefore may take but a very slight involvement of the parametrium by cancer for the growth to reach or extend beyond the ureters.

In carcinoma cervicis uteri this relation is altered in the following ways, as has been described in the above-mentioned article:[2]

1. By the distention of the cervix by the growth, thus bringing the cervix nearer the ureters.

2. By the direct invasion of the parametrium by the growth, and as this is apt to occur in the lower part of the parametrium, it does not need to go far in order to reach or extend beyond the ureters.

3. By metastases to the structures of the parametrium; as,

a. The large parametrial lymph nodes, especially the one sometimes found where the uterine artery crosses the ureter.

b. The minute parametrial lymph nodes, scattered throughout the parametrium, and which may be involved by carcinoma without increasing in size.

c. The (intravascular?) lymph nodes, also minute, which apparently protrude into the lymph channels like sponges and are apparently different in structure from the other minute lymph nodes, but like them may be involved by cancer without increasing in size, so that their presence can only be diagnosed with the microscope.

d. Other structures of the parametrium, as nerve sheaths, lymph channels, etc.

It becomes very evident that the ureter passes through tissue which should be removed; as shown by:

1. The large percentage of recurrences after hysterectomy for this disease.

2. The renal insufficiency resulting from the extension of the disease, thus compressing the ureters.

3. The accidental injury to the ureters in the operative treatment of the disease.

4. The anatomical relation between the cervix and the ureter under normal conditions shows that this relation is changed by the position of the uterus in the pelvis and the size of the cervix, and that in the lower portion of the parametrium it takes but very little involvement of this tissue by the cancer for the growth to reach or extend beyond the ureters.

5. The study of the parametrium by Kundrat in 80 operable cases showed that it was involved in over half the cases, and that in *half the cases in which it was involved, it had apparently checked the further advance of the growth,* as shown by a study of the pelvic lymphatics beyond the parametrium.

6. The study of the cases in which the ureters have been resected shows how easily the growth can reach or extend beyond the ureter, either by direct extension or by metastases, and that the diagnosis of cancer about or near the ureters can be definitely made only with the microscope, as shown by me in the article[2] previously referred to.

Two ways of removing all the tissue from pelvic wall to pelvic wall present themselves:

1. To dissect the ureters free from this tissue.

2. To remove the tissue with the lower ends of the ureters and implant the renal ends of the ureters into the bladder.

The object of this paper is to consider the effect of freeing the lower ends of the ureters in these operations, and whether or not it is justifiable, and if so how it should best be done. In order to determine the above, the subject must be viewed from the results of anatomical, experimental and clinical studies.

What Takes Place when the Ureters are Freed in the More Radical Operations for Carcinoma Cervicis Uteri.

If one will catheterize both ureters with silk bougies and, after grasping the cervix with traction forceps, make a bimanual pelvic examination, the relation between the cervix and the ureters may be determined, for the catheterized ureters can be easily palpated. While making the examination, if another person will displace the uterus by means of traction forceps, as pulling it down, pushing it up in the pelvic cavity and displacing it to the right or left side of the pelvis, a very good idea may be obtained of what effect these positions of the uterus have upon the ureters, which one can readily feel in the bimanual examination. Under normal conditions, the ureters are only slightly affected by these positions, unless extreme, and one can see that the distance of the ureters from the cervix is dependent mainly on the position of the uterus in the pelvis; i. e., when the uterus is in the right side of the pelvis, the left ureter bears nearly the same relation to the left side of the pelvis as the right does to the right side of the pelvis. On the other hand, the uterus is nearer the right ureter than the left, the distance depending on the degree of displacement. I studied these relations still more satisfactorily in the pelvis of a multipara, only a few hours after death. Catheters were inserted in the ureters from above and the bladder was opened and the catheters withdrawn until the ends appeared just at the ureteral orifice in the bladder. A bimanual examination was now made with one hand in the pelvis and the other in the vagina. The uterus was displaced by pulling it up in the pelvis, drawing it down and displacing it to the right and left side. While extreme displacement in either direction also displaced the ureters, one could see that the relation between the ureters and the cervix was mainly dependent on the position of the uterus in the pelvis, and that under normal conditions any displacement of a freely movable uterus, unless extreme, changed but very little the relation of the ureters to the sides of the pelvis and other fixed pelvic structures.

The pelvic portion of the ureter is surrounded by a sheath (described in previous articles [2 and 6]), which is adherent to the peritoneum in that part of the pelvic portion of the ureter which lies just under the peritoneum and situated above the parametrium (when the uterus is in anteposition; for in the retroposition the uterus may lie posterior to the ureters for their entire pelvic portion). The sheath of the lower pelvic portion of the ureter is firmly connected with the tissue along or through which the ureter passes and from which the sheath is derived and the isolation of this portion of the ureter with its sheath is very difficult. On the other hand, the sheath may be split open and the ureter easily shelled out. In freeing the ureters they are usually shelled out from this sheath and thus all vessels coming to that portion of the ureters are injured, and in addition there is danger of injuring their outer perimuscular fibrous coats, in which are situated the larger ureteral vessels. At the close of the operation the ureters lie in the pelvis as loose cords, deprived of their sheaths, and exposed to the danger of ureteral necrosis or ureteral obstruction.

In considering the effect of freeing the pelvic portion of the ureter, a knowledge of the efficiency of the blood-supply of the ureter is most important, and such knowledge can only be gained from anatomical, experimental, and clinical studies. A result of such studies has been published in a previous article.[6]

The Blood-Supply of the Ureter.

The ureter is nourished by a periureteral arterial plexus, the main trunks of which run in a longitudinal direction from the kidney to the bladder in the outer loose perimuscular fibrous coat of the ureter. From these longitudinal vessels small branches arise, some of which anastomose with each other, thus forming the mesh-work of the plexus. These smaller branches are, for the most part, more deeply imbedded in the outer coat of the ureter than the main trunks which in places may be but loosely united to the ureter. Small arteries arise from this plexus, penetrate the walls of the ureter, and thus supply the inner coats of the ureter. I do not know whether or not there is a free anastomosis between the deeper ureteral arteries. In sections of the ureter cut from specimens injected with Prussian-blue the free anastomosis of the capillaries can be demonstrated easily. On the other hand, I have never been able to determine whether or not there was any anastomosis between the small arteries found within the muscular coats. These vessels are not very numerous and are very small, as shown in Fig. II, and one would not suppose that they could nourish the ureter for any distance unless the plexus remained intact. This plexus is nourished mainly by the ureteral arteries which arise from branches of large vessels along the course of the ureter, as the aorta, renal, ovarian, iliac, uterine, and other arteries. The ureteral arteries are not the same in all cases, as a branch from one artery, as, for instance, the ovarian, present in one case, may be absent in another, and its place be taken by a branch from another artery, as the aorta, a ureteral branch of which may not be present in the first instance or both may be present in the latter case (see Fig I). This plexus may receive additional nourishment from small branches arising from the plexus of vessels which supply the tissue about the ureter, and may anastomose with the branches of other vessels supplying these parts.

An idea of the efficiency of this plexus may be gained from the following experiments which I made. In five instances the arteries of the ureter for its entire length were injected by inserting a canula into the renal artery through the incised aorta, using an aqueous solution of Prussian-blue in two instances and a 15 per cent solution of gelatine colored with ultramarine-blue in the other three. Fig. I was drawn from one of these specimens. The internal iliac artery was injected in the opposite side of one of the above cases, and as a result the arteries of the ureter were injected for its entire length. I have injected the internal iliac artery in another instance, the ovarian in one, and the abdominal aorta in two, first clamping the renal, iliac, and lumbar arteries in the latter two cases so that the coloring material could not enter these vessels. This latter group of cases was not quite as satisfactory as the first six cases referred to, as the work was done after the organs had been removed; nevertheless, they all demonstrated the free anastomosis of the arteries of the ureter, giving rise to a periureteral arterial plexus, and showed that it is possible to inject the entire plexus from such arteries as the renal and internal iliac, and also probably from any one artery which furnishes a ureteral artery. Through this plexus there is established an arterial communication between the kidney and the bladder, because when one injects the renal artery alone with ultramarine-blue, the particles of which will not enter the capillaries, in addition to the injection of the ureteral arterial plexus, both the bladder and the uterus are partially injected. The anastomosis of the renal with the ovarian and the latter with the uterine also aids in bringing this about.

From a knowledge of the blood-supply of the ureter it would seem that many liberties could be taken with the ureter without causing necrosis; as, for instance, the ureter could be dissected free, from the bladder to the kidney, severing all vessels coming to the ureter between these organs, and yet necrosis would not occur if the periureteral arterial plexus remained intact.

On the other hand, one would suppose that the destruction of this plexus for only a short distance would lead to necrosis of the ureter, for even if there existed a free anastomosis of the deeper arteries of the ureter, on account of their size and small number, one would think that they would not be capable of maintaining the nourishment of the ureter for any great distance.

Experiments on Dogs Demonstrating the Efficiency of the Blood-Supply of the Ureter.

In the article[6] previously referred to, I gave the results of some of my experiments and referred to the work of Monari, who showed that many liberties could be taken with the ureter of a dog, as it could be freed from the tissue surrounding it and if replaced in this tissue necrosis would not occur. On the other hand, if the ureter was freed, but for a short distance and gauze was placed about it, necrosis was very apt to occur.

There is an arterial plexus about the ureter of a dog very similar to that found in man. It receives branches from the vessels near it and presents variations much as are found in human beings. The main trunks of this plexus tend to arrange themselves in two relatively large branches, one on each side of the ureter, which are loosely bound to the ureter. The smaller branches arising from the trunks anastomose with each other, thus forming the mesh-work of the plexus, and are more closely united to the ureter than the larger vessels, as is also the case in man. On this account it is quite easy to injure the large trunks but not the smaller branches (see Figs. III, IV and V). The following experiments were done:

I. In seven dogs, the ureter was isolated for nearly its entire length and an attempt was made to strip off the periureteral arterial plexus with my finger nails. The dogs were killed in from one to four weeks and ureteral necrosis occurred in only two cases. In four of these cases the descending aorta was injected with a 15 per cent solution of gelatine colored with ultramarine-blue, and very satisfactory injections of the ureter were obtained. It could be seen in these specimens that in trying to strip off the arterial plexus I had removed only portions of the main arterial trunks and the large veins, while most of the smaller branches, which are imbedded more deeply in the outer coat of the ureter and form the mesh-work of the plexus, were uninjured and were able in five instances to maintain the arterial plexus, and thus the blood-supply of the ureter. In addition newly-formed vessels come to the ureter from the surrounding tissue, and also new vessels go out from the ureteral plexus into the surrounding tissue (see Fig. III).

II. In three cases the ureter was isolated for about 4 cm. and in order to completely destroy the plexus, the ureter was scraped on all sides with a very sharp knife, for a distance of 2 cm. Necrosis occurred in all three cases.

III. In three dogs a ureter was isolated for nearly its entire length, and then the larger vessels of the plexus were torn off by the finger nails and mouse-tooth forceps, as in the first experiments. Both uterine vessels were tied, thus ligating the ureteral arteries which complete the lower end of the plexus and arise from the uterine. Necrosis occurred in each instance.

IV. An attempt was made to simulate the condition sometimes found after the more radical operations for cancer of the uterus. In six dogs the ureter was isolated for about its lower one-third, and the tissue about it, including portions of the larger vessels of the plexus, was torn off as above. Both uterine arteries were tied and necrosis occurred in five of the six cases.

V. In two dogs the above was done, except the uterine artery on only one side was tied. Necrosis occurred in one case.

VI. In twenty-five uretero-vesical implantations in dogs, there was but one failure, which occurred in one of nine cases where organisms had been introduced into the bladder, in order to see the results of implanting the ureter in the presence of infection. In three of these nine cases the kidney became infected and in each instance there was a marked stricture of the ureter at the seat of the implantation.

VII. In another dog the ureter was freed and stripped, as in previous operations. A small rubber tube 8 cm. long was split, and by springing it apart the ureter was placed within its lumen. Necrosis of the ureter occurred for a length of 7.5 cm.

VIII. A dog's ureter was scraped with a sharp knife until a fistula was formed. The ureter was replaced in the abdominal cavity and 53 days afterwards the dog was killed. The kidney was found to be normal, the ureter patent, and there was no evidence of there having been any trouble except for the adhesions about the ureter.

It is evident that in a dog the ureter may not only be freed for its entire length, but its larger vessels may, in part, be destroyed by stripping them off; yet necrosis will not necessarily occur, for the plexus may be maintained by the smaller branches which are more adherent to the ureter and are very difficult to remove, and also by such portions of the large branches as have not been destroyed. On the other hand, when the ureter is scraped with a sharp knife, thus destroying the smaller branches as well as the larger, necrosis will occur, even though the distance be very short. Again, when the ureter is freed but a short distance and the plexus interfered with, and in addition the arteries supplying the lower end of the ureter are ligated, then necrosis is very apt to occur, for the portion of the ureter stripped and also that below the injury, must receive most of its blood-supply from the blood-vessels in the plexus above the injury, and the stripping may interfere with the blood reaching these parts through the injury to the plexus.

In injury to the ureteral plexus, veins are destroyed as well as arteries, but as there is a very free anastomosis between the veins of the ureter, one would expect much less trouble from injury to the veins. Nevertheless, it must embarrass the circulation to a degree, varying with the extent of the injury. Infections, exudates, and foreign material, as gauze, must all be considered as accessory etiological factors in the causation of ureteral necrosis.

So far, the results of the study of the blood-supply of the ureter in man and experiments on animals tally. The next thing to be considered is what may be learned from clinical experience.

CLINICAL CASES DEMONSTRATING SOME OF THE INJURIOUS RESULTS ARISING FROM FREEING THE URETERS IN THE MORE RADICAL OPERATIONS FOR CARCINOMA CERVICIS UTERI.

Clinical cases showing the efficacy of the blood-supply of the ureter have been referred to in a previous article. In this article attention was called to the fact that many liberties could be taken with the ureter. The human ureter has been dissected free for its entire length and yet necrosis has not occurred, and even when its outer coat is injured the ureter may be preserved. On the other hand, if the periureteral arterial plexus is injured sufficiently necrosis will occur.

There have been six instances of ureteral necrosis in 156 hysterectomies for cancer of the cervix in this hospital, and not a single instance of such a complication following the many times that the ureter has been accidentally exposed in other gynecological operations. I have abstracted the main points in these six cases.

Case I.—Mrs. M. W. Age 46. Gyn. No. 5991. Gyn. Path. No. 2301.

Diagnosis: Squamous cell carcinoma cervicis uteri.

Prognosis bad, for sections through the edge of excision of the growth showed that it probably had not been all removed.

Operation: Hystero-salpingo-oöphorectomy, combined abdominal and vaginal, with preliminary catheterization of the ureters with silk catheters.

Steps in the Operation Interfering with the Blood-Supply of the Ureters.

1. The right ureter was found to be surrounded by the growth and with difficulty was dissected free from it.

2. Uterine arteries were tied.

3. Pelvis drained through the vagina with gauze, which probably came in contact with the right ureter.

Nature of the Ureteral Injury.

Right uretero-vaginal fistula, appearing on the ninth day when the pelvic packs were removed. Otherwise, convalescence was uneventful.

Result: Six weeks later an attempt was made to turn the uretero-vaginal fistula into the bladder, by a plastic operation through the vagina. Operation was unsuccessful. The fistula persisted until death two month later, apparently from renal infection.

Case II.—Mrs. S. R. Age 24. Gyn. No. 8788. Gyn. Path. No. 4994.

Diagnosis: Squamous cell carcinoma cervicis uteri.

Prognosis bad, for from a microscopical study of the specimen the growth had apparently not been all removed.

Operation: V, 30, 1901. Hystero-salpingo-oöphorectomy, combined abdominal and vaginal, with preliminary catheterization of the ureters, with silk catheters.

Steps in the Operation Interfering with the Blood-Supply of the Ureters.

I. Both ureters were dissected free from the carcinomatous cervix to which they were adherent. The right ureter was the more adherent. The ureters thus stood out like two cords from above the middle of their pelvic position to their insertion into the bladder.

II. Both internal iliac arteries were tied.

III. Gauze drains were placed through the vagina, which probably came in contact with the ureters.

Nature of the Ureteral Injury.

Right uretero-vaginal fistula, manifesting itself by a discharge of urine from the vagina on the tenth day.

Result: Patient died a year later from recurrence of the growth. Fistula persisted off and on until shortly before death.

Case III.—Mrs. A. M. Age 64. Gyn. No. 9256. Gyn. Path. No. 5757.

Diagnosis: Squamous cell carcinoma cervicis uteri.

Prognosis bad, for the growth had extended out to the edge of excision.

Operation: Hystero-salpingo-oöphorectomy, combined abdominal and vaginal, preliminary catheterization of the ureters.

Steps in the Operation Interfering with the Blood-Supply of the Ureters.

I. Both ureters were dissected free from about the middle of their pelvic portion to their entrance into the bladder.

II. The left internal iliac artery was ligated. On the right side the uterine artery was ligated at its origin.

III. The pelvis was drained through the vagina with gauze, which probably came in contact with the ureters.

Nature of the Ureteral Injury.

Bilateral uretero-vaginal fistula; bilateral renal infection.

Convalescence: Uneventful until the tenth day, when urine appeared in the vagina and none was present in the bladder. A month later urine came from both vagina and bladder, and the presence of purulent urine in the bladder, with chills and fever, the temperature reaching 103° suggested renal infection. Six weeks after the operation, the vaginal leakage ceased. Cystoscopic examination made at that time showed that there was a stricture of the left ureter, for a catheter could be forced but 2 cm. into the ureteral orifice, while on the right side a catheter was passed 5 cm. into the ureter, passing three strictures, and purulent urine escaped from the catheter, thus indicating renal infection.

Result: A letter received from her physician a short time ago, 18 months after the operation, stated that at present there was no evidence of a return of the growth and that the patient was apparently in good health.

Case IV.—Mrs. N. B. Age 64. Gyn. Nos. 9492, 9534, 9881 and 10,168. Gyn. Path. No. 5758.

Diagnosis: Squamous cell carcinoma cervicis uteri.

Prognosis bad, for sections showed that the growth had extended out to the edge of excision.

Operation: Hystero-salpingo-oöphorectomy, abdominal with Downes cautery clamp. Preliminary catheterization of the ureters.

Steps in the Operation Interfering with the Blood-Supply of the Ureters.

I. The left ureter was dissected free for its lower pelvic portion as the left broad ligament was involved by the growth.

II. Cautery clamps, which are apt to burn further than would appear, and by destroying surrounding tissue interfere with secondary collateral circulation, were used.

III. Pelvic drains of gauze, which probably came in contact with the left ureter.

Nature of the Ureteral Injury.

Left uretero-vaginal fistula. On the fifteenth day a large amount of watery vaginal discharge was noticed, and later a diagnosis of left ureteral fistula was made. Cystoscopic examination made four weeks after the operation showed that a portion of the urine came from the ureter into the bladder and a portion through the fistula. Leakage from fistula stopped five weeks after the operation, or three weeks after the appearance of the fistula. The patient was readmitted September 5, 1902, three and a half months later. A diagnosis of bilateral renal infection made. Urine from both kidneys was turbid. Repeated washing out of both kidneys through renal catheters with silver nitrate, 1-2000, improved her general condition and she left the hospital much improved after remaining here two months. At this time there was no evidence of a return of the growth.

Patient returned January 5, 1903, after two months' absence. She felt better for the first few weeks but afterwards began to have pain in her left groin and large quantities of pus in her urine. Irregular nodular masses could be felt in the lower part of the pelvis. The cancer had returned.

Result: Return of carcinoma. Bilateral renal infection.

Case V.—Mrs. C. H. Age 49. Gyn. No. 10,084. Gyn. Path. No. 6284.

Diagnosis: Squamous cell carcinoma cervicis uteri. Local growth all removed, but metastases were found in the lymph nodes of the parametrium.

Operation: Hystero-salpingo-oöphorectomy, abdominal. Preliminary catheterization of the ureters.

Steps in the Operation Interfering with the Blood-Supply of the Ureters.

I. Both ureters were dissected free from their entrance into the parametrium to the bladder.

II. The uterine arteries were ligated and cut lateral to the ureters.

III. The pelvis was drained through the vagina with gauze, taking care that it should not come in contact with the ureters.

Convalescence: Patient did badly; died on the sixth day. Pulse rapid, temperature rose to 103.2° on the sixth day, but fell to 100.2° in the next eight hours, and just before death rose to 101.4°. Patient was drowsy, although the amount of urine excreted was over 1 liter a day after the first 48 hours.

Autopsy was negative. Cause of death not found. The ureters were carefully examined for any evidence of necrosis and in the right ureter, about 2 cm. above its entrance into the bladder, there was found a slight aneurysmal dilatation. Fig. XXII is a drawing made from a longitudinal section of the ureter at this place, showing that local necrosis has occurred and that the ureter is about to rupture at this point, thus giving rise to a ureteral fistula.

Result: Death as result of operation; cause not determined. Ureteral necrosis.

Case VI.—Mrs. A. M. Age 48. Gyn. No. 10,622. Gyn. Path. No. 6860.

Diagnosis: Squamous cell carcinoma cervicis uteri. Lymph node removed from the division of the left common iliac into the internal and external branches was found to be carcinomatous.

Operation: VII, 25, 1903. Abdominal hystero-salpingo-oöphorocystectomy. Freeing the lymphatics from the pelvic vessels and removing with them the uterus and growth, together with all the parametrium. The ureters were dissected free from their parametrial sheath by splitting it open lengthwise from its outer side. Preliminary catheterization of the ureters.

Steps in the Operation Interfering with the Blood-Supply of the Ureters.

I. Both ureters were dissected free from their parametrial sheath for a distance of 4 cm.

II. Both uterine arteries were tied at their origin.

III. Gauze drainage: (a) Through vagina, but gauze did not come in contact with the ureters; (b) sides of the pelvis lateral to the ureters were drained extraperitoneally through incision made just above Poupart's ligament on both sides. Possibly the lateral extraperitoneal drains came in contact with the ureter.

Nature of the Ureteral Injury.

Convalescence was uneventful until the thirteenth day, when urine appeared in the vagina. Flank drains were started in two days and removed in four days. Pelvic drains through vagina were all removed by the seventh day.

The patient left the hospital four weeks after the operation, with a severe cystitis, all the urine from the left kidney coming through the vagina.

Patient was readmitted two weeks later. Apparently all the urine from the left kidney came through the vagina.

Cystoscopic examination: Bladder apparently normal. Urine cultures showed a growth of colon bacillus. About one-half of the urine came through the vagina. IX, 15, 1903, 53 days after the first operation, the left ureter was resected and reimplanted in the bladder, through an incision parallel to Poupart's ligament, extraperitoneally. Cocain in the form of Schleich's solution was used as a local anesthetic. There was no evidence of leakage until the eighth day, when apparently about half of the urine came through the inguinal incision. Firm pads were placed over this incision and a tight bandage was put in; the leakage ceased but *the amount of urine passed through the bladder did not increase.* The patient did not have any untoward symptoms. A week later the amount of urine excreted each day had gradually increased, but did not reach the amount passed before the leakage had occurred. As no urine appeared at the site of the inguinal incision, a probable diagnosis was made of occlusion of the ureter. This was apparently confirmed by cystoscopic examination. The end of the ureter could be seen in the bladder, but repeated examinations over long periods of time failed to show any evidence of urine coming from the ureter, and repeated attempts at catheterizing the ureter failed. The catheter could be passed in about 1 cm. and then met an obstruction. The most probable diagnosis was that a second ureteral fistula had resulted from ureteral necrosis, and as it had time to become imbedded in scar tissue before forming, firm pressure had favored an occlusion of the ureter with a resulting cure of the fistula, but at the same time destruction of the kidney without any localizing or constitutional symptoms.

Pathological Changes Caused by Freeing the Ureters.

In the consideration of the above the ureter is not the only part concerned, but of still greater importance is the integrity of the kidney, whose function is dependent on an intact ureter, and also the effect of the escape of urine sterile or infected into the retroperitoneal tissue or into the general peritoneal cavity, should a ureteral fistula form as the result of the injury.

Conclusions based on anatomical studies, animal experimentation and the review of cases reported in the literature, justify one in saying that many liberties may be taken with the ureter, but that injury to its outer perimuscular fibrous coat, in which is situated the periureteral arterial plexus, is likely to cause ureteral necrosis.

The basis of this work is formed for the most part from experiments on dogs, but in a few instances I have been able to study the ureters of patients who have died after operations in which the ureters have been freed. The blood-supply of a dog's ureter is very similar to that of the human being, so experiments may be done simulating the various steps in operations involving the ureter, and the results of these experiments may be studied at different stages in the process of ureteral necrosis. The final results of these experiments, i. e., whether necrosis occurred or not, have already been referred to in this article. I shall now describe the pathological changes taking place in the ureter itself as a result of interfering with its blood-supply, and also the changes in the other parts and organs affected by the injury.

One must consider two classes of cases; first, those in which necrosis does not occur; secondly, those in which it does take place.

I. Changes which Take Place when Necrosis Does not Occur.

These changes manifest themselves in disturbances in the circulation of the ureter and thus an impairment of its function; and secondly, in the results of adhesions forming about the ureter with the chance of causing a stricture of the ureter.

A. *Circulatory Disturbances, not Sufficient to cause Ureteral Necrosis.*

1. *Arterial.*—The first effect of injuring the outer coat of the ureter is a diminished blood-supply to that part of the ureter, but this may soon be compensated for by a hypertrophy of the smaller vessels of the plexus which have not been injured and necrosis may thus be avoided. Later on, as adhesions form newly-formed vessels arise in the adhesions, some

extending from the surrounding tissue to the ureter and others from the ureter into the surrounding tissue. See Figs. III, IV, and V.

2. *Venous.*—In freeing the ureter, veins are injured as well as arteries, and as there is a very free anastomosis of the deep ureteral veins, these may become greatly engorged, as shown in Fig. VI, from a patient dying on the fifth day from intestinal obstruction, following a radical operation for cancer of the uterus in which the ureter had been freed, with but very little injury to the ureteral vascular plexus.

The only effect of these circulatory disturbances of the ureter which can be appreciated is that the ureter becomes swollen—compare Figs. IV and V—and this may embarrass the kidney by offering resistance to the escape of urine from that organ.

B. *Effect of Adhesions Forming About the Ureter.*

The ureter may be kinked or the adhesions may form a stricture giving rise to partial or complete ureteral obstruction, just as intestinal obstruction may occur. I have seen such conditions result from experimental work on dogs, and Fig. VII represents a hydro-ureter as a result of adhesions formed around a freed ureter, the patient[7] dying on the ninth day from renal infection of the opposite kidney.

II. URETERAL NECROSIS.

Two distinct classes of cases must be considered; first, those in which a fistula does not form; secondly, those in which the ureter ruptures and there follows an escape of urine into the surrounding tissue.

1. *Ureteral Necrosis in which a Rupture Does not Occur.*

The first change which manifests itself is an extravasation of blood into the ureteral tissue between the epithelium lining the lumen and the muscular coats. This condition is associated with necrosis of the part and is probably dependent on the necrosis; in other words, the condition is that of a hemorrhagic infarction. See Fig. VIII. This may be localized or may involve the ureter for several centimeters, depending on the extent of the injury. As the condition progresses the infarcted area becomes more distinct, the center failing to take the hematoxylin stain, while about the periphery can be seen a deeply stained border caused by the fragmentation of nuclei and the proliferation of cells outside of these. Fig. IX. This condition causes a swelling of the ureteral tissue with a resulting narrowing of the ureteral lumen, so that at the junction of the necrotic and living portion of the ureter a stricture develops (Fig. X), giving rise to a hydro-ureter above (Fig. XI), while below the necrotic area the ureter becomes swollen and here one can see the compensatory hypertrophy of the smaller ureteral arteries. Compare Figs. XII and XIII. While this condition has been going on the ureter has become imbedded in adhesions which protect the ureter and help prevent a rupture, Figs. IX, X, and XIV. Later on, at the end of two or three weeks, newly-formed vessels begin to penetrate the necrotic portion of the ureter and convert it into fibrous tissue (Fig. XIV) or the central necrotic portion may slough with a complete loss of the mucosa and muscular coats, Fig. XV. The extent of the process depends on the extent of the injury; the inner coats are affected first, and the outer fibrous coat becomes hypertrophied and very resistant (Fig. IX) and soon newly formed vessels enter it from the surrounding tissue with which the ureter may come in contact (Figs. XIV and XV). These newly-formed vessels maintain the nourishment of the outer ureteral coats but the inner coats have already become necrotic, and while vessels may invade it, the mucosa and muscular tissue have already been destroyed and the ureter may be converted into a fibrous cord.

The effect on the kidney is that of a progressing ureteral stricture (See Figs. XVI, XVII, XVIII, XIX) with corresponding hydro-ureter, hydro-nephrosis, and destruction of renal tissue. In some cases when the injury is light the kidney may continue to function with a persistent ureteral stricture, while in others, the kidney may be thrown out of function by destruction of the ureter. Added to these changes is the danger of ascending renal infection.

2. *Ureteral Necrosis Leading to a Ureteral Fistula.*

Why does a fistula occur in some cases and not in others? The first portions of the ureter affected are the inner coats, and the outer perimuscular fibrous coat is the last part affected; while necrosis is occurring in the inner coats of the ureter, the outer coat is becoming imbedded in adhesions. If the necrosis is very extensive or there is anything to prevent the formation of adhesions, which splint and protect the ureter, or if the adhesions are insufficient, then a fistula is likely to form. When the injury is very extensive, then the ureter for a long distance may be destroyed and exist as a friable necrotic tube, which, unless firmly imbedded in adhesions, will permit of an extravasation of urine. On the other hand, if the necrosis is more localized and the necrotic area is not well protected by adhesions, then an aneurysmal dilatation will occur at this place, which is likely to rupture and give rise to a ureteral fistula. In Fig. XXII this aneurysmal dilatation due to localized necrosis is shown. The specimen was obtained from a patient who died six days after the operation, the cause of death not being determined at autopsy. It is impossible to state whether in this specimen the early condition of the process was that of a hemorrhagic infarction or that of an ulceration. Judging from experimental work, it probably began as an infarcted area.

The effect of the formation of a fistula depends upon whether it becomes encapsulated or finds an outlet, and also of the greatest importance, whether or not the urine becomes infected. When the opening is small there may be an extravasation of urine and a final healing of the fistula. I scraped a dog's ureter with a sharp knife until a fistula appeared. It was dropped back into the peritoneal cavity discharging urine from the fistula, yet when the dog was killed 53 days later, the only trace of the injury was that the ureter was imbedded in adhesions at this place. On the other hand, the injury may be more extensive, with loss of ureteral tissue, and if the urine becomes encapsulated, as shown in Fig. XX, the ultimate result is throwing the kidney out of function by destruction of the ureter. The extravasated urine may become infected and escape into the peritoneal cavity, giving rise to general peritonitis, as occurred in one dog; or may lead to renal infection; or, as shown in Fig. XXI, the urine may become encapsulated, then infected, and by direct extension up along the ureter a paranephritic abscess may be formed. Another possibility is that the urine may find an outlet, and *the formation of a uretero-vaginal fistula is the usual indication of post-operative ureteral necrosis.*

Etiological Factors in the Causation of Ureteral Necrosis.

These may be:

1. Injury to the periureteral arterial plexus.
2. Injury or ligation of the ureteral arteries themselves, or arteries which furnish these vessels.
3. Anything interfering with the formation of adhesions about the ureter, which splint and protect the ureter, and through which vessels may come to the ureter; as,
   (a) An infection.
   (b) An exudate.
   (c) Foreign bodies, as gauze, etc., separating the ureter from the surrounding tissue.
   (d) Necrosis of the tissue with which the ureter comes in contact, as might result from the use of the cautery.
4. Stricture of the ureter below the injured area, thus distending the weakened ureter.

When the uterine artery is tied at its origin, the ureteral vessels derived either directly or indirectly from this artery are destroyed; furthermore, if the ureter is dissected free, ureteral arteries coming from other vessels to that portion of the ureter are also destroyed, as from the vaginal, middle and inferior vesical arteries. By the above procedure the blood-supply of the lower 4-6 cm. of the ureter has been destroyed, except that coming from above through the periureteral arterial plexus, which we know is sufficient to prevent necrosis. If the ureter is handled roughly in shelling it out from its sheath, or from adherent cancerous tissue, there is danger of ureteral necrosis, for the smaller blood-vessels within the ureteral wall are too small and few in number (even if they do anastomose with each other?) to nourish the ureter but for a very short distance. It can readily be seen that an exudate or infection about the injured ureter would increase the liability of necrosis, as would also gauze, necrosis of the surrounding tissue, and anything interfering with the function of the ureter. To the above must be added the possibility of general lowered resistance.

Diagnosis of Ureteral Necrosis.

There are two distinct classes of cases which must be considered, one in which necrosis occurs but a fistula does not form, and a second in which the well-known tell-tale fistula arises.

In the first class of cases we are dealing with the gradual formation of a ureteral stricture, which may be temporary or permanent, and which may even lead to occlusion of the ureter. In the absence of infection, and if the patient recovers, this will probably never be diagnosticated unless a cystoscopic examination is made and the ureters are catheterized. Even if the patient dies, the injury could easily be overlooked. If renal infection occurs the diagnosis may be very difficult. I have had two patients die from ascending renal infection following these operations, one on the ninth and the other on the seventeenth day.[7] In one case, the ureters had been resected but not in the other. Both patients were free from pain and there were no symptoms referable to renal infection except the fever and constitutional symptoms associated with it. Even should urine escape, unless it manifests itself by escaping through the vagina or abdominal incision, its diagnosis would be very difficult, for it might become encapsulated, the kidney finally cease to function and the results would be similar to those cases in which the ureter became occluded. Should the urine form a mass which could be palpated in bimanual examination, then a diagnosis might be made; or should the injury lead to a hydronephrotic mass which could be palpated, then some injury to the ureter would be suspected. *The most important aid in diagnosing these injuries is keeping an accurate account of the amount of urine obtained from the bladder, which should be measured every 4 to 6 hours.* A sudden diminution in this amount, especially if associated with any constitutional disturbances, suggests that there may be some ureteral injury, and if marked enough would warrant a cystoscopic examination and catheterization of the ureters. *One must remember that the ureter may become completely occluded or a renal or pararenal infection may take place without a single localizing symptom.* While localized pain helps in such a diagnosis, the absence of such pain does not exclude such conditions. The appearance of urine through the vagina or abdominal incision makes clear the diagnosis of a ureteral or vesical fistula. I shall not go into the differential diagnosis between the two. The earliest day at which a ureteral fistula appeared in our cases was the ninth, and the latest the fifteenth. Wertheim[8] reports a case in which the escape of urine did not appear until after three weeks.

Prognosis of Ureteral Necrosis.

In those cases in which a fistula does not form, the ureter may recover with but little or no interference with its function. On the other hand, the injury may be sufficient to cause a temporary or permanent stricture, or even complete occlusion with corresponding renal insufficiency (Figs. XVI, XVII, XVIII and XIX). Associated with these changes is the danger of renal infection. Even when the ureter ruptures and an extravasation of urine occurs, the ureter may recover if the opening is small, as shown by this experiment. I scraped a dog's ureter at one place until an opening in the ureter was made, and yet when the dog was killed, 53 days later, the ureter was pervious, and the same repair may take place in women, as shown by the spontaneous healing of those cases in which a fistula develops. When an extravasation of urine occurs and the ureteral injury is too extensive to heal, then undoubtedly the urine may be absorbed, the ureter occluded, and the kidney functionally destroyed. Of great danger in these cases is the chance for infection with the formation of a localized abscess or the possibility of an ascending renal infection. This infected urine may become localized or may spread, causing a general peritoneal infection, as occurred in one dog, or an ascending para-ureteral infection with the formation of a paranephritic abscess (Figs. XXI and XXIV).

Prognosis When a Uretero-Vaginal Fistula Forms.

This fistula may heal spontaneously, as two of our six cases did, one of which was double, thus making three fistulæ. In Case No. III the leakage ceased 32 days after its appearance, and in Case No. IV, 21 days; but in both instances ureteral stricture resulted with renal infection, as shown by catheterizing the ureters and making cultures from the urine from each kidney.

The fistula may persist for a long time. In Case I it persisted until death two months after its appearance, apparently from renal infection; while in Case II it persisted until "shortly before death," from a recurrence of the growth one year after the operation. The great danger associated with a ureteral fistula is that of ascending renal infection. This occurred in at least three of the five cases in which a fistula developed, *i. e.*, Cases I, III and IV, Case I probably dying as a result of renal infection.

TREATMENT OF URETERAL NECROSIS.

Unless a uretero-vaginal fistula forms the diagnosis is very difficult. Should the necrosis be bilateral and a fistula not form, then renal insufficiency might develop from partial or complete occlusion of the ureters. Catheterizing the ureters might not only make the diagnosis, but possibly temporarily relieve the condition. In some cases an exploratory laparotomy might be necessary in order to form a ureteral fistula or implant the ureters into the bladder should the condition of the patient permit it. If an extravasation of urine occurred and was diagnosed, it should be opened and drained.

What shall be done with the uretero-vaginal fistula? Some will heal spontaneously, but with stricture, and in many instances an ascending renal infection. Nephrectomy will cure not only the fistula but also the renal infection of that side. A surgeon can argue justly that an infected kidney with a strictured ureter is an organ dangerous to life and should be removed. There is one great drawback to nephrectomy in these cases, and that is the danger of renal insufficiency. For in the original operation both ureters had been freed, and while a fistula may have formed only in one, there is abundant opportunity for renal insufficiency of the other kidney resulting from partial or complete obstruction of its ureter, as a result of its having been freed at the previous operation. Nevertheless, one may find in the literature such cases cured by nephrectomy, and Wertheim[8] reports two such cases in a paper previously referred to in this article. Should one contemplate such treatment, the sufficiency of the other organ ought to be determined first.

Plastic operations, such as turning the fistula into the bladder through the vagina, will undoubtedly relieve some cases, but the renal infection and the stricture, both of which are probably present, especially the latter, are not likely to be relieved by such an operation, for the stricture is in most cases responsible for the maintenance of the renal infection.

Resection of the ureter and reimplantation into the bladder seem to me to offer the best chance of maintaining the renal sufficiency, relieving the stricture and curing the renal infection if present. This should be done extraperitoneally and the wound freely drained at the close of the operation. I realize that such an operation is very difficult, for the ureter is imbedded in scar tissue and there is great danger of ureteral necrosis occurring from dissecting the ureter from this tissue. Nevertheless, it saves a kidney, which is especially desirable when the other organ is likely to be insufficient. I did this in one case, No. VI, and ureteral necrosis probably occurred, but the patient was cured by a probable occlusion of the ureter, as has been described. Fortunately, the other kidney had escaped and was sufficient.

THE AVOIDANCE OF URETERAL NECROSIS.

Anatomical, experimental and clinical experience have taught us that many liberties may be taken with the ureter without causing necrosis. On the other hand, an injury to its outer loose perimuscular fibrous coat, which contains the periureteral arterial plexus, is likely to cause ureteral necrosis. This plexus may be injured by cutting off its blood-supply by the ligation of ureteral arteries or the larger vessels from which these arteries arise, as the uterine, anterior branch of the internal iliac, or the internal iliac artery itself. This injury alone probably never results in ureteral necrosis, for if *the plexus itself is uninjured* the ureter may be nourished from the renal artery alone. I have injected the entire ureter and portions of the bladder and uterus by injecting the renal artery alone, using a granular injection mass which could not pass through the capillaries, thus demonstrating that the entire injection was arterial and that an arterial communication existed between the bladder and the kidney through the ureteral arteries. Nevertheless, in all operations there should be as little injury to the blood-supply of the part as possible. Consequently, in these operations the ligation of the uterine artery alone is sufficient and attended with less danger than the ligation of the internal iliac artery or its anterior branch.

The most important etiological factor in the causation of injury to the periureteral arterial plexus is the actual injury to the plexus arising from handling the ureter roughly after it has been freed from the sheath which protects the ureter and its plexus. When the ureter has been isolated and all vessels coming to that part have been cut off by freeing the ureter, that portion of the ureter freed must be nourished by vessels coming from above through the plexus, and if the plexus is injured in dissecting the ureter free, necrosis may occur.

Clinical experience and a study of the parametrium shows that the tissue about the ureters should be removed in these operations. Anatomical, experimental, and clinical studies demand that the periureteral arterial plexus must be preserved.

Two ways of preserving the periureteral arterial plexus present themselves: First, to dissect the ureter with its sheath free, thus preserving the arterial plexus; secondly, to resect the lower ends of the ureters and implant the renal ends of the ureters into the bladder. The dissection of the pelvic ureteral sheath free from its surrounding structures is difficult, for it is derived from these, as shown in a previous article;[2] likewise, the sheath frequently becomes involved in the extension of the growth, and while this procedure may be possible in the early cases it is attended with the danger of leaving disease behind in the more advanced ones, and unfortunately a positive diagnosis of cancer in the parametrium can only be made by the use of the microscope. On the other hand the ureter may be shelled out from this sheath and if great care is taken necrosis will not occur but if the plexus is sufficiently injured necrosis will take place, and of great importance a new sheath may be derived from the surrounding tissue.

The removal of all the tissue from pelvic wall to pelvic wall with the lower ends of the ureters offers the greatest chance for a cure, and at the same time the ureteral sheath and periureteral arterial plexus may be preserved, for the portion of the ureter which is above the parametrium lies beneath the peritoneum, and this peritoneal flap may be brought down and, with the ureteral sheath, sutured to the bladder. The suturing of the sheath and the peritoneum to the bladder relieves the tension of the implantation, and the periureteral arterial plexus is preserved and also the ureteral sheath. Against this procedure are the uncertainties of the uretero-vesical implantation and the danger of ascending renal infection. Careful work should minimize the chance of failure in the uretero-vesical implantation, and possibly the formation of a vesico-vaginal fistula at the close of the operation will lessen the danger of ascending renal infection, as discussed in previous articles.[2, 5 and 7]

Other accessory etiological factors in the causation of ureteral necrosis must be considered and avoided if possible. The presence of an exudate or infection will endanger the vitality of the injured periureteral arterial plexus, and on this account the area must be drained. On the other hand, the presence of gauze placed between the injured ureter and the surrounding tissue is a foreign body which deprives the ureter of any nourishment and support (splinting) which it may receive from this tissue with which it should come in contact. When the area is drained care must be taken not to have the drain come in contact with the ureter. The condition of the tissue which the ureter rests upon after freeing is most important, for if the vitality of this tissue is preserved the ureter will become adherent to it and will be nourished by it. On the other hand, if the vitality of this tissue is interfered with, then the ureter will not only be deprived of this nourishment but will lie in contact with necrotic tissue, which will predispose the ureter to necrosis. The following conditions interfere with the nourishment of this tissue:

1. The ligation of large vessels, as the internal iliac or its anterior branch, which are unnecessary.
2. The use of the cautery or cautery clamp, destroying this tissue.
3. Unnecessary mass ligatures.
4. Exudates and infection.

An avoidance of the above will greatly aid the preservation of the blood-supply of the ureter, no matter what the nature of injury or operation involving it.

Conclusions.

I. The ureter passes through tissue which should be removed in every instance of hysterectomy for carcinoma cervicis uteri; as shown by:

1. The large percentage of recurrences after hysterectomy for this disease; 88 per cent of the cases operated upon in this hospital, after a period of five years, showing recurrences (cases reviewed in October, 1902).
2. The renal insufficiency resulting from a compression of the ureters by the extension of the disease.
3. The accidental injury to the ureters in the operative treatment of the disease; 19 in 156 hysterectomies for carcinoma cervicis uteri, as compared with 11 instances of accidental ureteral injury in 4513 other major gynecological operations in this hospital.
4. The proximity of the cervix to the ureters and the relation between the two may be greatly altered under physiological conditions, by steps in operations and by pathological processes.
5. Kundrat has shown that the parametrium was involved in 44 of 80 operable cases, and that in half of these cases the parametrium was able to check the further progress of the disease.
6. A study of the parametrium in those cases in which the ureters have been resected shows that it takes but very little involvement by direct extension or metastases for the growth to reach or extend beyond the ureters and that the presence of this growth can be diagnosed only with the microscope, as I have emphasized in a previous article.[2]

II. The pelvic portion of the ureter lies in a sheath which protects the ureter and its periureteral arterial plexus and is derived from the tissue through which the ureter passes, and on this account the isolation of the ureter with the sheath is very difficult. On the other hand, the sheath may be split open and the ureter easily shelled out.

III. The effect of freeing the ureter from its sheath manifests itself in the opportunity for partial or complete ureteral obstruction resulting from the kinking or imbedding of the ureter in adhesions (Fig. VII) and also in circulatory disturbances resulting from injury to the blood-supply of the ureter, which vary according to the severity of these disturbances and may present the following conditions:

1. Injuries to the larger branches of the ureteral plexus, where the smaller branches are able to enlarge and maintain the nourishment of the ureter, thus preventing necrosis (Figs. III, IV and V).

2. Venous congestion due to injury of the larger veins, causing distension of the deeper ureteral veins which anastomose freely with each other (Fig. VI).

3. Necrosis of the ureter which may or may not give rise to an extravasation of urine, depending on the extent of the injury and whether or not the ureter becomes imbedded in adhesions.

IV. Necrosis of the ureter apparently begins as a hemorrhagic infarct and the inner coats of the ureter are the parts first affected, while the outer perimuscular fibrous coat is the part last affected. In the early stages hemorrhage with necrosis is noticed first in the tissue beneath the epithelium (Fig. VIII). The size of the area involved and also the extent of the process depends on the severity of the circulatory disturbances. Later on the tissues in the infarcted area fail to take the hematoxylin stain, while about the periphery of this area is a deeply staining border, due to fragmentation of nuclei and proliferation of cells outside of these (Figs. IX and X). The outer fibrous ureteral coat becomes greatly thickened (Fig. IX) unless it also becomes necrotic.

V. Rupture of the ureter may not occur because the necrosis was not extensive enough, and also the ureter may become imbedded in adhesions which splint it and help nourish the outer ureteral coat by means of vessels coming in from the surrounding tissue (Figs. XIV and XV). The effect of necrosis is a stricture due to swelling caused by the necrotic tissue. This stricture may be temporary or permanent, depending on the severity of the process, or the necrosis of the ureter may be so extensive as to cause complete occlusion of the ureter with loss of function of the kidney (Figs. XVI, XVII, XVIII and XIX).

VI. Rupture of the ureter may occur, leading to an extravasation of urine, which may become encapsulated (Fig. XX), if infected lead to renal or pararenal infections (Fig. XXI) or other localized or diffuse infectious processes. When the urine finds an outlet through the vagina or abdominal incision a *ureteral fistula is formed which is the usual manifestation of ureteral necrosis.* The ureteral rupture is due to the extent of the necrosis, especially if the outer ureteral coat is involved, and the failure of the ureter to become imbedded in adhesions due to gauze, exudates, infection, or sloughing of surrounding tissue.

VII. Ureteral fistulæ may heal spontaneously, but probably always with a stricture and frequently with renal infection, which may cause the death of the individual. Frequently they persist over long periods of time with all the discomforts and dangers associated with this condition. In some cases they may close, with occlusion of the ureter and a loss of function of the kidney.

VIII. The most important etiological factor in the causation of ureteral necrosis is injury to the periureteral arterial plexus, arising from tearing or otherwise injuring the plexus, as may occur in dissecting the ureter free. Other etiological factors must be considered, as the ligation of vessels supplying the plexus, exudates, infection, destruction of tissue about the ureter, as would result from the use of the cautery, foreign bodies against the ureter (as gauze), pressure on the ureter, stricture below the injury, and lowered general resistance.

IX. Dissecting the ureter free from its sheath in these operations is attended with danger of interfering with the function of the ureter and of causing ureteral necrosis, and should be avoided when possible and if done great care should be taken not to injure the periureteral arterial plexus.

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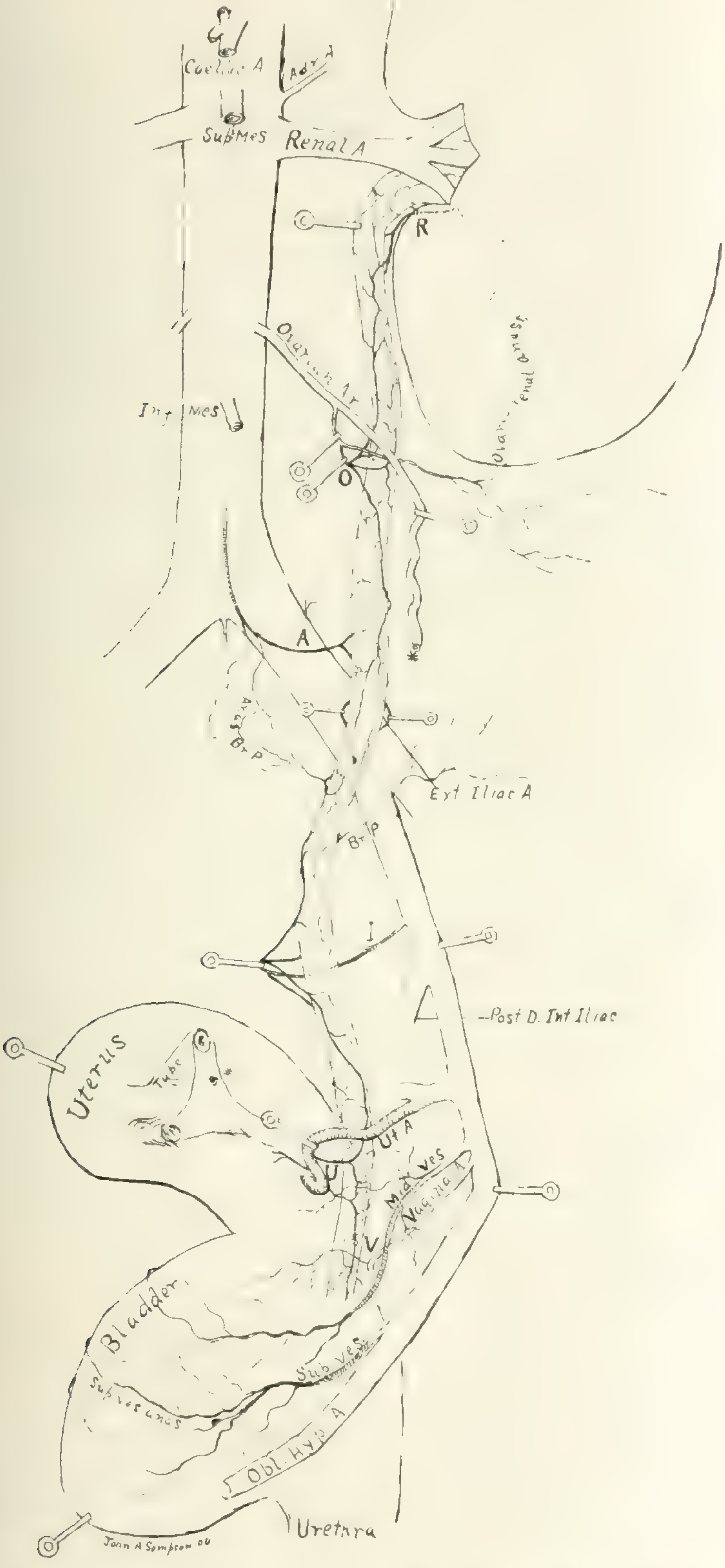
Coeliac A
Adr A
Sub Mes
Renal A
R
Ovarian Ar
Ovario-renal anast
Int Mes
O
A
*
Anas Br P
Ext Iliac A
Br P
I
Post D. Int Iliac
Uterus
tube
*
Ut A
U
Mid Ves
Vagina A
V
Bladder
Sub Ves
Sub ves anas
Obl. Hyp A
Uretnra
John A Sampson 04

FIG. I. THE PERIURETERAL ARTERIAL PLEXUS FROM A WOMAN 21 YEARS OLD. × 1/5. LEFT URETER.

The left renal and right internal iliac arteries were injected with a 15 per cent solution of gelatine, colored with ultramarine blue. The organs were removed and hardened in 10 per cent formalin. The drawing was made from the dissected hardened specimen.

The periureteral arterial plexus in this instance is derived from branches of the aorta, renal, ovarian, internal iliac, uterine, and vaginal arteries, marked, A, R, O, I, U, and V.

Uterus drawn upwards and to the right, the tube and ovary have been removed.

Contracted bladder, drawn downwards and to the right.

Ovario-Renal Anast. Anastomosis between the subperitoneal branches of the uretero-subperitoneal arteries, arising from the renal and ovarian arteries.

* * Anastomosis between the uterine and ovarian arteries, cut away by the removal of the tube and ovary.

Br. P. Branch from the periureteral arterial plexus supplying the tissue about the ureter.

Anas. Br. P. Anastomosis between the subperitoneal branch of the aortic uretero-subperitoneal artery, and a branch arising from the plexus.

Sup. Ves. Anas. Anastomosis of the superior vesical artery of one side with the superior vesical artery of the other side.

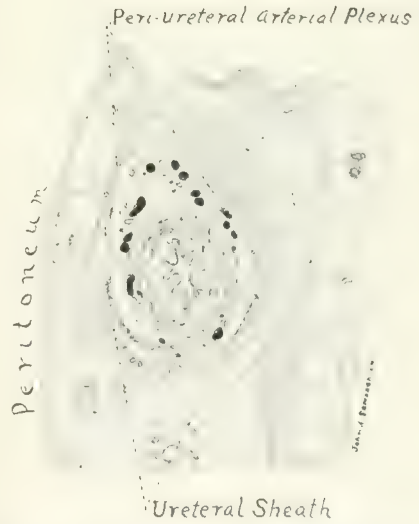
Peri-ureteral arterial Plexus
Peritoneum
Ureteral Sheath
John A Sampson

FIG. II. CROSS SECTION OF URETER, SHOWING THE PERIURETERAL ARTERIAL PLEXUS AND THE URETERAL SHEATH, IN A WOMAN, 21 YEARS OLD. × 5. RIGHT URETER.

The left renal and the right internal iliac arteries were injected with a 15 per cent solution of gelatine, colored with ultramarine blue. The organs were removed and hardened in 10 per cent formalin. The drawing was made from a cross section of the right ureter taken about 15 cm. above the uterus. Same case as one from which Fig. I was made.

For the sake of clearness, only the ureteral arteries are drawn, as injected. The capillaries and the veins were not injected. The periureteral arterial plexus, situated within the ureteral sheath, can be seen cut across as well as the small arteries in the walls of the ureter. This sheath is apparently derived from the pelvic connective tissue and serves as a protection to the ureter and its periureteral arterial plexus. The arteries in the ureteral walls are small in size and number and on this account, even should they anastomose freely with each other, would not be able to nourish the ureter for any great distance if the periureteral arterial plexus was destroyed.

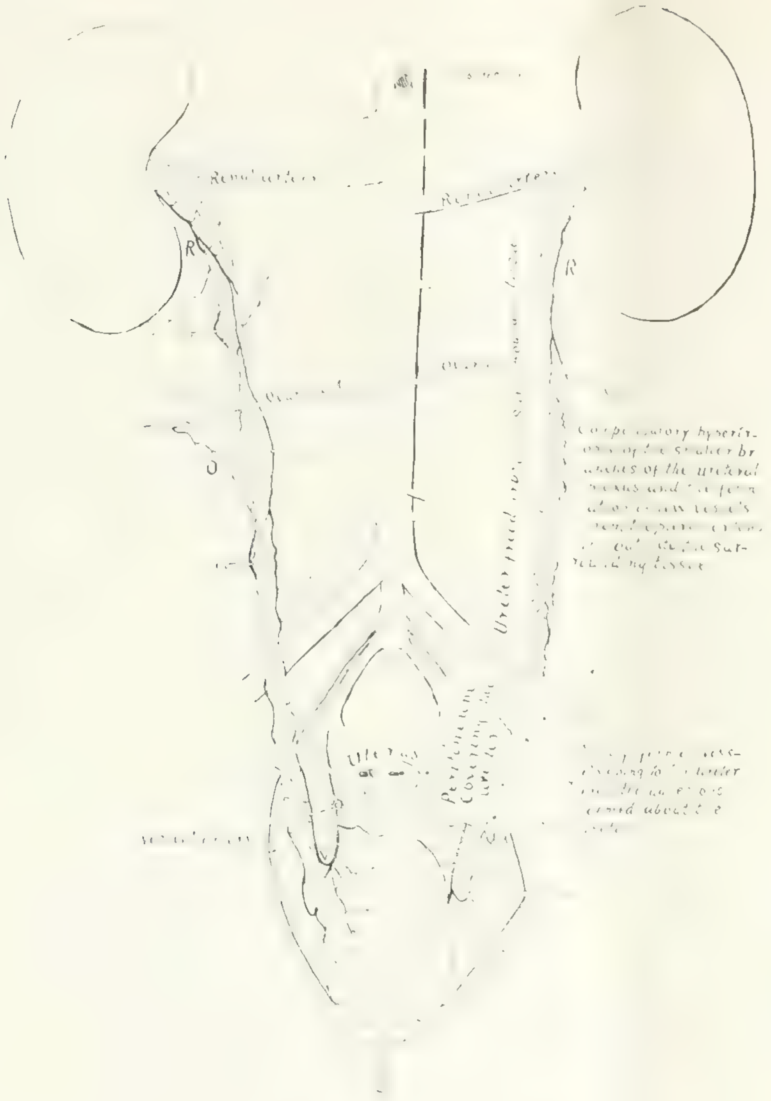

FIG. III.—RESTORATION OF THE BLOOD SUPPLY OF THE URETER FOLLOWING INJURY TO ITS PERIURETERAL ARTERIAL PLEXUS. DOG NO. 1, × 1

Portions of the arterial plexus of the lower two-thirds of the left ureter were torn off with forceps, injuring the main trunks of the pelvis.

The dog was killed at the end of two weeks and the descending aorta was injected with 15 per cent gelatine, colored with ultramarine blue.

The ureter of the dog is nourished by a periureteral arterial plexus similar to that found in human beings, the main trunks being more loosely attached to the ureter than its smaller branches and are therefore more easily injured.

Following injury the ureter becomes imbedded in adhesions and there is a hypertrophy of the smaller branches which have escaped injury and likewise new vessels arise from the ureter and from the newly-formed adhesions about the ureter.

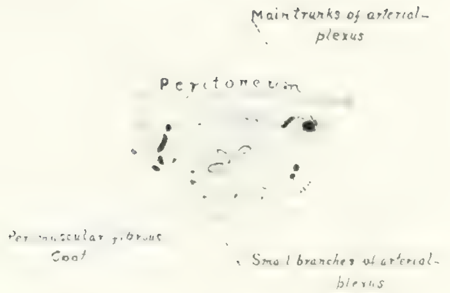
Main trunks of arterial plexus
Peritoneum
Perimuscular fibrous Coat
Small branches of arterial plexus

FIG. IV.—CROSS SECTION OF A DOG'S URETER SHOWING THE RELATION BETWEEN THE MAIN TRUNKS OF THE PERIURETERAL ARTERIAL PLEXUS AND THEIR SMALLER BRANCHES. DOG, NO. 9, × 8.

The left ureter of a dog was freed for nearly its entire length and portions of the arterial plexus were stripped off. The dog was killed at the end of two weeks and the descending aorta was injected with 15 per cent gelatine, colored with ultramarine blue.

This illustration is from the uninjured ureter and shows that the main trunks of the plexus are but loosely attached to the ureter while the smaller branches are more deeply imbedded in the outer perimuscular fibrous coat of the ureter, and on this account it is difficult to injure them. Note the small size and number of the deeper ureteral arteries, for ultramarine blue being granular does not enter the capillaries.

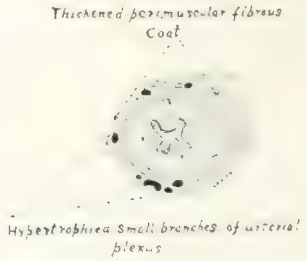
Thickened perimuscular fibrous Coat
Hypertrophied small branches of arterial plexus

FIG. V.—CROSS SECTION OF A DOG'S URETER, SHOWING THE COMPENSATORY HYPERTROPHY OF THE SMALLER BRANCHES OF THE ARTERIAL PLEXUS FOLLOWING INJURY TO ITS LARGER TRUNKS. DOG NO. 9, × 8.

From same dog as illustrated in Fig. IV. Cross section of injured ureter. The main trunks of the arterial plexus, shown in Fig. IV, have been stripped off from the ureter, but the smaller branches, also shown in Fig. IV, being imbedded in the outer perimuscular fibrous coat of the ureter, escaped injury and have become hypertrophied, thus maintaining the nourishment of the ureter. The ureter itself has become thickened.

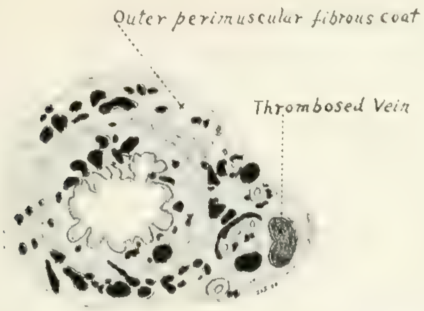

FIG. VI. CROSS SECTION OF A URETER WHICH HAS BEEN FREED IN THE MORE RADICAL OPERATION FOR CARCINOMA CERVICIS UTERI, SHOWING THE PASSIVE CONGESTION DUE TO INJURY OF THE LARGER VEINS. GYN. NO. 10,494. GYN. PATH. NO 6715, × 6.

Patient died on the 5th day from intestinal obstruction. The lower portion of the ureters had been freed in the operation and this specimen was obtained from the freed portion of the right ureter.

There is a free anastomosis of the deeper ureteral veins and when the outer main trunks are injured these deeper veins become engorged, as shown in the drawing, probably interfering somewhat with the function of the ureter, and thus possibly the passage of urine from the kidney to the bladder.

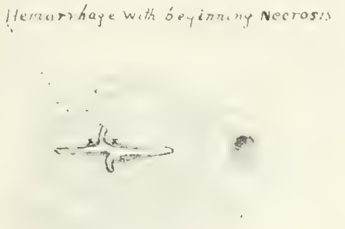

FIG. VIII.—CROSS SECTION OF DOG'S URETER, SHOWING BEGINNING NECROSIS AS THE RESULT OF INJURY TO THE PERIURETERAL ARTERIAL PLEXUS. DOG NO. 22, × 8.

The left ureter of a dog was freed for 4 cm. and then the periureteral arterial plexus was removed and the ureter scraped on all sides for a distance of 2 cm., thus not only destroying the main trunks of the arterial plexus, but also injuring the smaller branches which are more adherent to the ureter (see Fig. IV). The dog was killed in two days.

The necrossis manifests itself as a necrosis with hemorrhage into the tissues just beneath the epithelium.

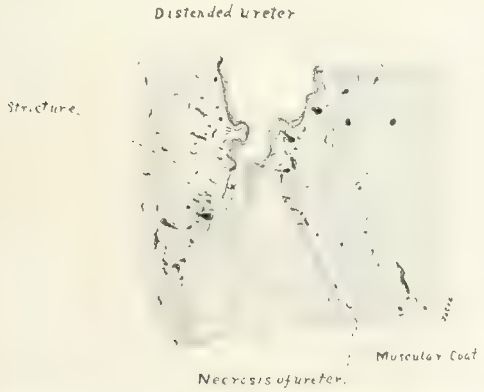

FIG. X. LONGITUDINAL SECTION OF A DOG'S URETER AT THE JUNCTION OF A NECROTIC WITH AN INTACT PORTION. DOG NO. 5, × 8.

One can see how the necrosis begins in the inner coats of the ureter and leads to swelling with stricture, causing hydroureter above, and below presenting the picture shown in Fig. XII. Compare this drawing with the one shown in Fig. XIII, which is the normal ureter from the same dog.

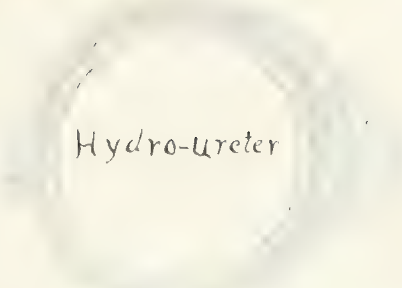

FIG. VII. HYDROURETER RESULTING FROM FREEING THE URETERS IN THE MORE RADICAL OPERATIONS FOR CARCINOMA CERVICIS UTERI, THUS DEPRIVING THE URETER OF ITS SHEATH AND RENDERING IT LIABLE TO PARTIAL OR COMPLETE URETERAL OBSTRUCTION FROM ITS BECOMING IMBEDDED IN ADHESIONS. GYN. NO 10,432, × 6

Patient died on the ninth day from ascending renal infection of the right kidney. The left ureter, where it had been freed, was imbedded in adhesions, giving rise to a hydroureter above.

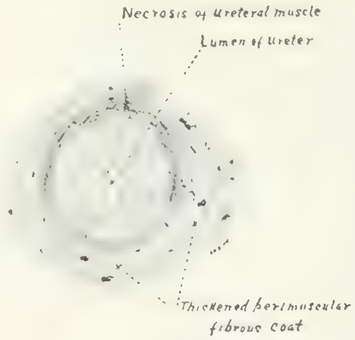
Necrosis of ureteral muscle
Lumen of ureter
Thickened perimuscular fibrous coat

FIG. IX.—CROSS SECTION OF A DOG'S URETER, SHOWING NECROSIS OF ALL THE URETERAL COATS EXCEPT THE OUTER PERIMUSCULAR FIBROUS COAT. DOG NO. 5, × 8.

The lower portion of the ureter was freed and portions of the arterial plexus were removed with forceps.

The dog was killed at the end of one week and the descending aorta was injected with 15 per cent gelatine, colored with ultramarine blue. The ureter had become necrotic for a distance of 2 cm. This represents a section through the necrotic area, showing that the outer fibrous coats had escaped. The inner coats present the picture of a hemorrhagic infarction, the epithelium has disappeared and the central portion fails to take the hematoxylin stain, while about this is a deeply staining border caused by the fragmentation of nuclei and proliferation of cells.

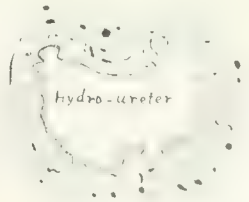

FIG. XI.—CROSS SECTION OF HYDROURETER CAUSED BY STRICTURE BELOW, DUE TO URETERAL NECROSIS. DOG NO. 5, × 8.

Same dog as shown in Figs. IV and V.

Section taken above the stricture shown in Fig. X, showing the distension of the ureter caused by the necrosis below.

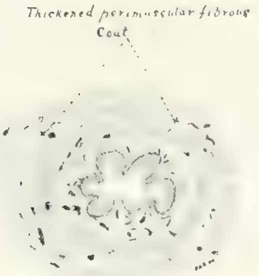
Thickened perimuscular fibrous Coat

Fig. XII.—Cross Section of Ureter Below Necrotic Portion, Showing Distention and Hypertrophy of Deeper Ureteral Vessels. Dog No. 5, × 8.

Section taken just below necrotic area shown in Fig. X.

The ureter is much swollen and the deeper ureteral arteries are hypertrophied and distended, due to injury of the arterial plexus. Compare with Fig. XIII, which represents a cross section of the normal ureter from the same dog.

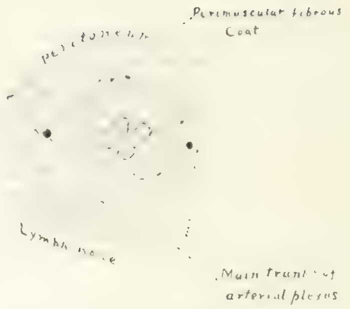
peritoneum
Perimuscular fibrous Coat
Lymph node
Main trunk of arterial plexus

Fig. XIII.—Cross Section of Dog's Ureter, Showing Normal Arterial Blood Supply. Dog No. 5, × 8.

Normal ureter from same dog as illustrations shown in Figs. IX, X, XI and XII, with which compare, noticing the difference in the size of the deeper blood vessels and of the diameter of the ureter in the injured and intact ureter.

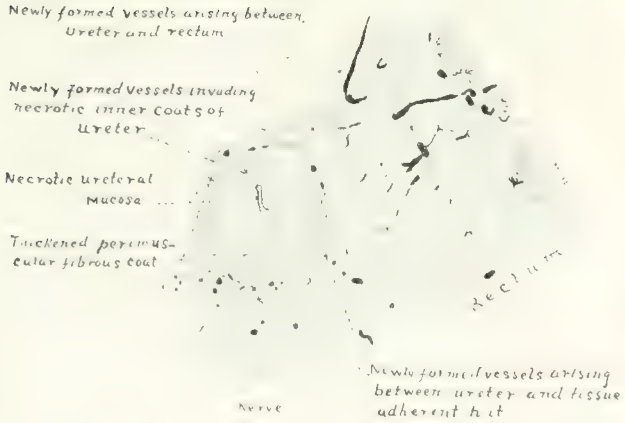
Newly formed vessels arising between ureter and rectum
Newly formed vessels invading necrotic inner coats of ureter
Necrotic ureteral Mucosa
Thickened perimuscular fibrous coat
Rectum
Nerve
Newly formed vessels arising between ureter and tissue adherent to it

Fig. XIV.—Cross Section of Dog's Ureter, Showing Necrosis of Inner Coats, with Newly Formed Vessels Invading the Necrotic Tissue. Dog No. 7, × 8.

Larger vessels of ureteral plexus were stripped from the left ureter and both uterine arteries were ligated.

Dog was killed in three weeks and descending aorta was injected with 15 per cent gelatine, colored with ultramarine blue. Result: ureteral necrosis with stricture and hydroureter and hydronephrosis (see Fig. XIX). The outer fibrous coat of the ureter has lived and newly formed vessels can be seen entering it from the surrounding tissue, for the ureter became adherent to the rectum.

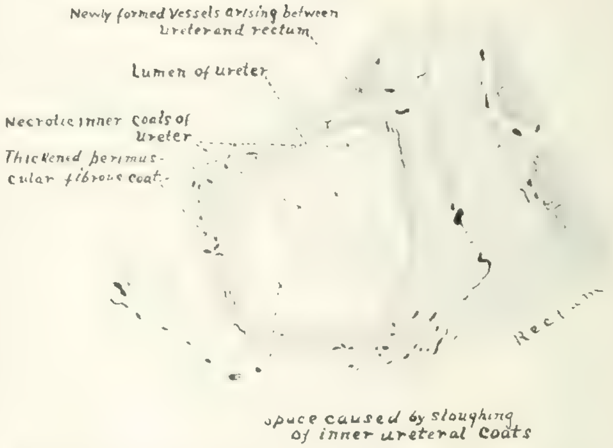
Newly formed Vessels arising between Ureter and rectum
Lumen of ureter
Necrotic inner Coats of ureter
Thickened perimuscular fibrous coat
Rectum
Space caused by sloughing of inner ureteral Coats

Fig. XV.—Section Taken Just Above the One Shown in Fig. XIV. (See also Fig. XIX.)

Shows the preservation of the outer perimuscular fibrous coat, and also the sloughing of the inner ones which had become necrotic.

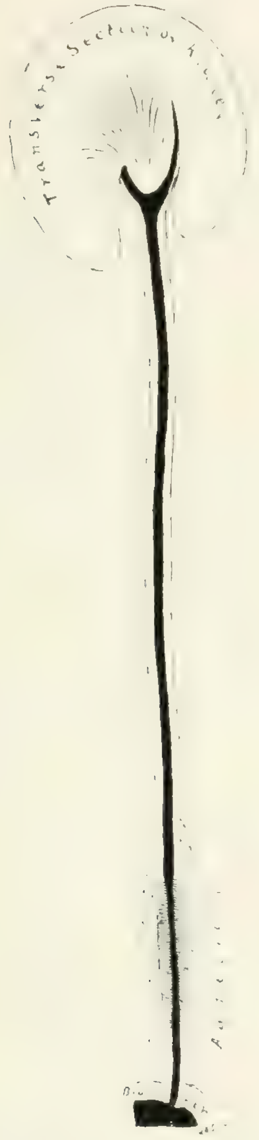
Transverse Section of Kidney
Adhesions

Fig. XVI.—Semi-diagrammatic Representation of the Effect of Ureteral Necrosis on the Ureter and Kidney. Dog No. 19, × 1.

The left ureter was stripped from its surrounding tissue for a distance of 4 cm. and scraped with a sharp knife The dog was killed in four days and necrosis of the inner and portions of all the ureteral coats had occurred, causing swelling of the ureter with stricture formation and beginning hydroureter above. The necrotic portion is represented by the shaded lines and this portion of the ureter has become imbedded in adhesions.

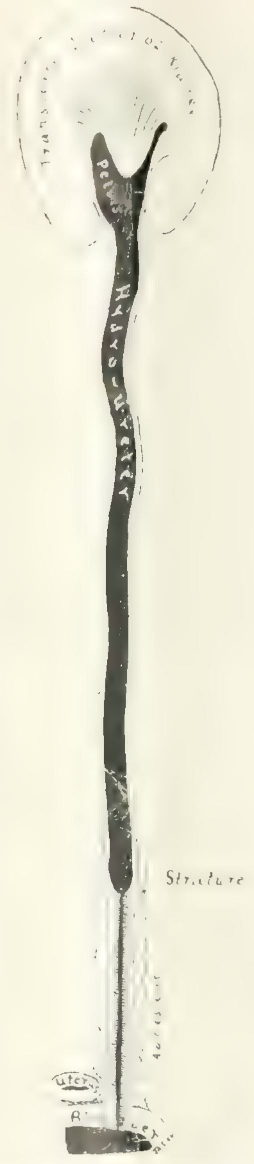
Transverse Section of Kidney
Pelvis
Hydro-ureter
Stricture
Adhesions
Uterus
B

Fig XVII As in Fig. XVI. Dog No 17, × 1.

The periureteral arterial plexus was injured by stripping portions of it off for the lower one-half of the ureter; the vesical arteries were tied, which complete the lower end of the ureteral plexus. The dog was killed at the end of one week. One sees a later stage of the effect of the necrosis shown in Fig. XVI. The ureter has become almost occluded with hydroureter above and beginning hydronephrosis, and also the ureter is more tortuous. Sections IX, X, XI and XII, while from another case, represent very well the changes shown in this drawing.

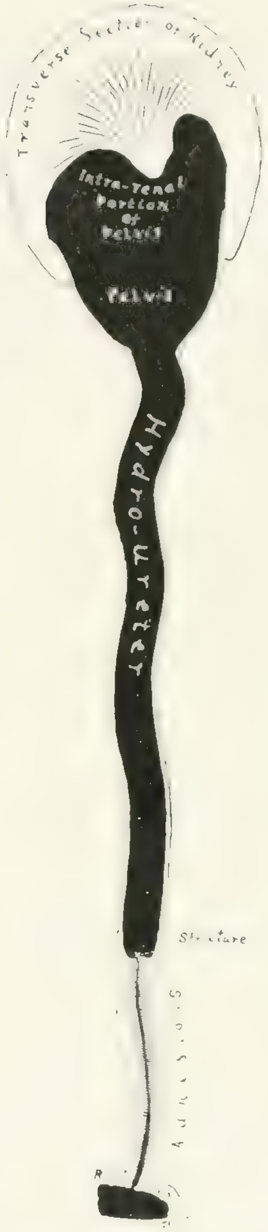
Transverse Section of Kidney
Intra-renal Portion of Pelvis
Pelvis
Hydro-ureter
Stricture
Adhesions
R

Fig. XVIII. As in Figs. XVI and XVII. Later Condition Dog No. 16, × 1.

The periureteral arterial plexus was injured by stripping portions of it away from the lower part of the left ureter, and the vessels were tied which complete the lower end of the ureteral plexus on both sides. The dog was killed at the end of three weeks. One sees a later stage of the effects of necrosis shown in the previous illustration The hydroureter and hydronephrosis is more marked, as well as the tortuosity of the ureter.

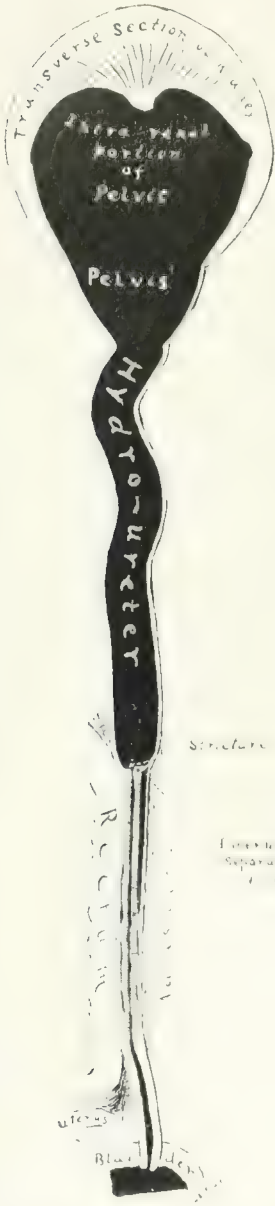
Transverse Section of Kidney
Extra-renal portion of Pelvis
Pelvis
Hydro-ureter
Stricture
Rectum
Necrotic inner coats separating from outer fibrous coat
uterus
Bladder

FIG. XIX. SPECIMEN FROM WHICH ILLUSTRATIONS XIV AND XV WERE MADE. DOG No. 7, [illegible] 8.

The ureter has become greatly distended and very tortuous, the pelvis of the kidney has become markedly distended, with loss of kidney tissue.

The necrotic ureter has become adherent to the rectum and is splinted and nourished by it. The inner coats of ureter are necrotic and in places are separating, as a slough from the outer fibrous coat (see Fig. XVI). The ureter was occluded and the kidney thrown out of function.

An extravasation of urine did not occur, due to the fact that the outer fibrous coat did not become necrotic and was nourished by the surrounding tissue.

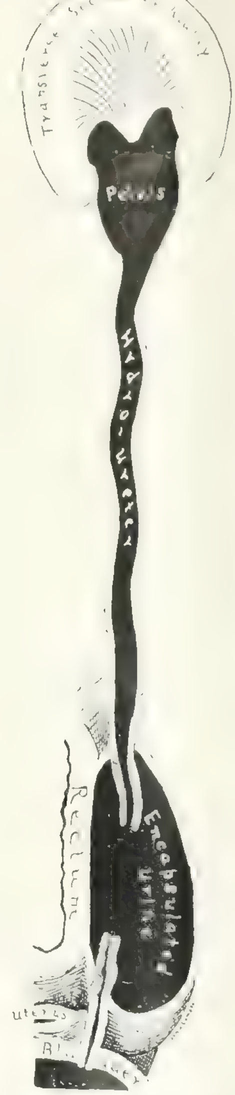
Transverse Section of Kidney
Pelvis
Hydro-ureter
Rectum
Encapsulated Urine
uterus
Bladder

FIG. XX.—SEMI-DIAGRAMMATIC REPRESENTATION OF THE EFFECT OF URETERAL NECROSIS WHERE AN EXTRAVASATION OF URINE OCCURRED WHICH BECAME ENCAPSULATED. DOG No. 8, [illegible] 1.

Experiment similar to the one illustrated in Fig. XIX. In the former instance the ureter became imbedded in adhesions and an extravasation of urine did not occur. In this instance the necrosis was so extensive and the adhesions were so slight that a rupture was not prevented. The urine became encapsulated, the rectum forming the mesial wall of the sac and the thickened peritoneum the rest of the sac. Hydroureter and hydronephrosis resulted from this and probably the urine would eventually have been absorbed, the ureter occluded, and the kidney ceased to function.

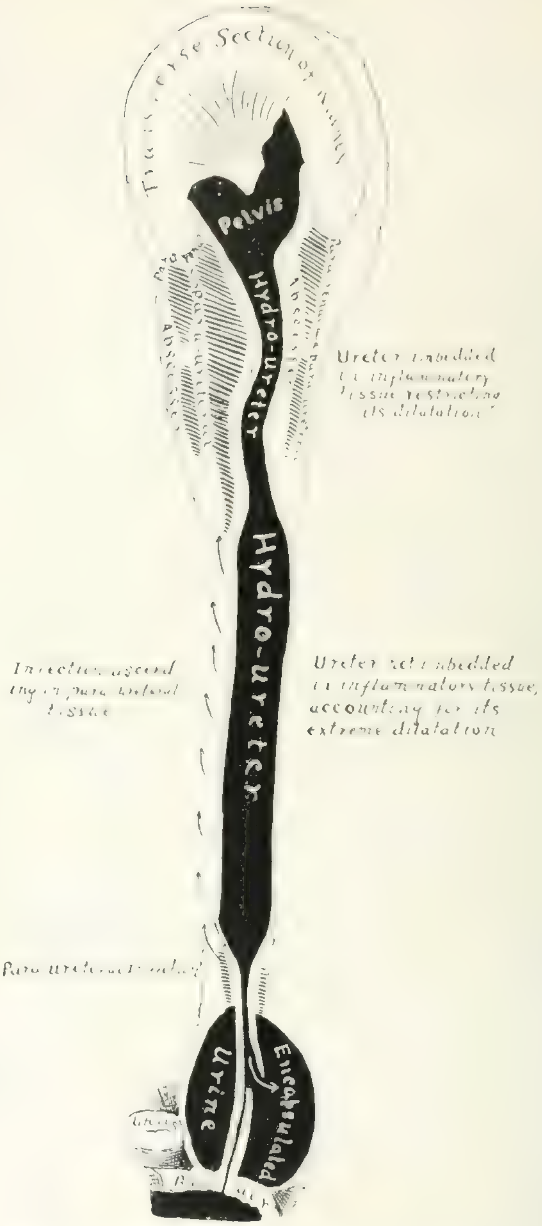
Transverse Section of Kidney
Pelvis
Hydro-ureter
Abscesses
Ureter imbedded in inflammatory tissue restricting its dilatation
Infection ascending in paraureteral tissue
Hydro-ureter
Ureter not imbedded in inflammatory tissue, accounting for its extreme dilatation
Paraureteral
Urine
Encapsulated
Bladder

FIG. XXI. SEMI-DIAGRAMMATIC REPRESENTATION OF AN ASCENDING PARAURETERAL AND PARARENAL INFECTION, FROM AN EXTRAVASATION OF URINE. DOG No. 26, [illegible] 1.

Same cases as represented in Fig. XXIV. The ureter ruptured, the urine escaped, then became encapsulated and infected.

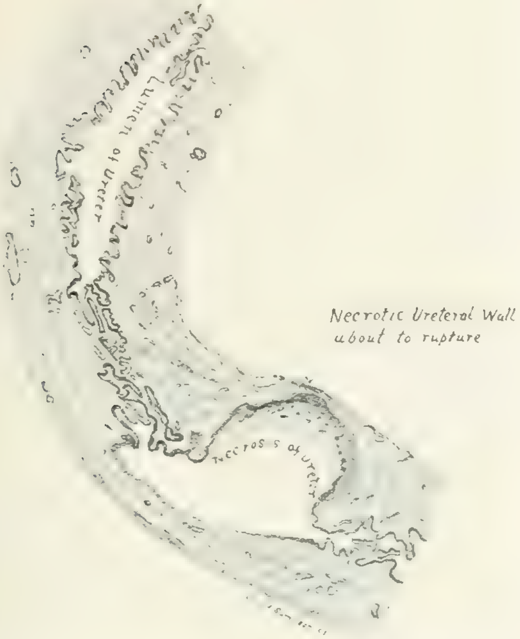
Lumen of ureter
Necrotic Ureteral Wall about to rupture
Necrosis of ureter

Fig. XXII. Localized Necrosis of Ureter About to Rupture, Following Freeing of the Ureter in the More Radical Operations for Carcinoma Cervicis Uteri. Gyn. No. 10,084, × 4.

Ureters had been freed. Patient died on the 6th day. Cause of death was not determined. Longitudinal section of right ureter. It is impossible to say whether this began as a localized ulceration or hemorrhagic infarction; judging by animal experimentation it was the latter.

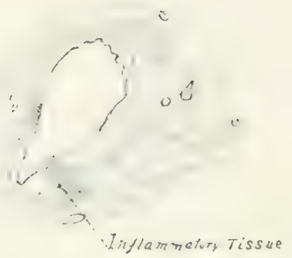
Inflammatory Tissue

Fig. XXIII. Cross Section of Ureter where Ascending Renal Infection has Occurred Following the Freeing of the Ureters in the More Radical Operations for Carcinoma Cervicis Uteri. Gyn. No. 10,432, × 4.

Same case as one represented in Fig. VII, but opposite ureter.

The cystitis had extended through the bladder wall and had involved the ureter and extended up it; this might cause necrosis.

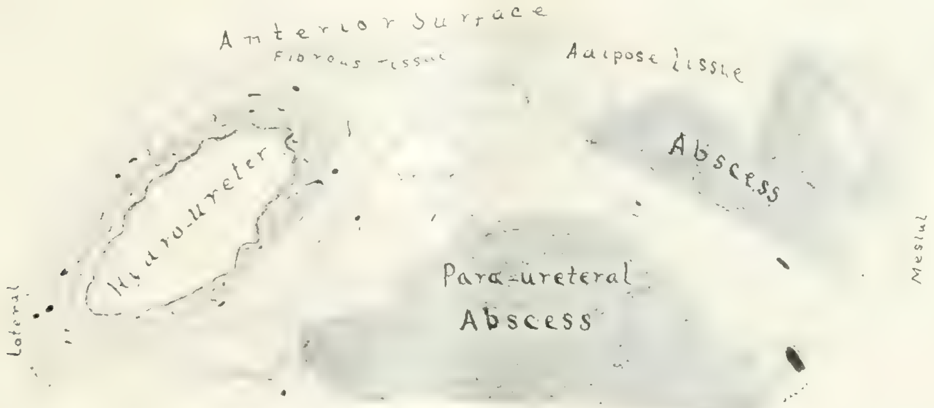
Anterior Surface
Fibrous tissue
Adipose tissue
Abscess
Hydro-ureter
Para-ureteral Abscess
Lateral
Mesial

Fig. XXIV. Shows the Relation of the Ascending Paraureteral Infection to the Ureter. Dog. No. 26, × 8.

Left ureter of a dog was scraped on all sides for a distance of 2 cm., thus injuring not only the larger vessels of the arterial plexus but also the smaller branches.

The dog was killed in six days and necrosis with rupture was found. The urine became encapsulated, then infected, and an ascending paraureteral infection occurred, also giving rise to a pararenal infection (see Fig. XXI).

THE SILVER BOLT AS A MEANS OF FIXING UNUNITED FRACTURES OF CERTAIN LONG BONES.

By Stephen H. Watts, M. D.,

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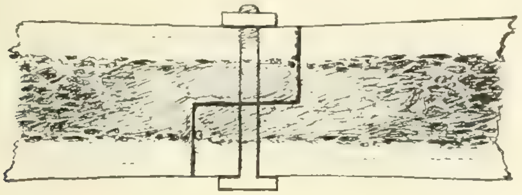
Doubtless everyone, who has had much to do with ununited fractures, realizes how unsatisfactory they are to deal with, and how uncertain are the mechanical means employed to fix them. Numerous methods have been recommended: silver wire, nails, screws, plates, hooks, ivory pegs, bony rings and other more complicated apparatus. Most of these methods will not hold the fragments in good apposition if they tend to become displaced.

About two years ago I was present at an operation for ununited fracture of the shaft of the femur. The fragments had been mortised together and wired, the wound in the soft parts then being closed. As the plaster cast was about to be applied, a snap was heard and the wire was found to be broken. The wiring had to be repeated. At that time it occurred to me that a silver bolt, substituted for the wire, would not only hold the fragments much more securely, but in much better apposition. I had some bolts made and a few months ago we used one of them in a case of ununited fracture of the shaft of the femur, near the junction of its middle and upper thirds.



The patient, a man 32 years of age, was brought to the hospital on June 24, 1903, with the history of having been injured in a stone quarry some hours previously. On examination he was found to have a very bad compound, comminuted fracture of both bones of the right lower leg and a compound fracture of the left femur, the skin opening over the site of fracture being quite small. This wound was thoroughly cleaned and a plaster cast applied. An attempt was made to save the right leg also, but five days later it became necessary to amputate it just above the knee. The fractured left femur was treated in plaster until August 7, 1903, when, no union being present, and considerable overriding of the fragments being discovered, the casts were discontinued and Buck's extension applied. The small wound in the soft parts had healed some time before.

On August 21, 1903, two months after the injury, no union having taken place, the limb was operated upon. The ends of the fragments, which overlapped several centimeters, lay in a definite sac filled with clear fluid; evidently an early stage in the formation of a false joint. The sac was excised, the bones mortised step-wise, care being taken to preserve as much periosteum as possible, and the silver bolt inserted in an antero-posterior direction as shown in the accompanying diagram. The nut was screwed down and the projecting portion of the bolt cut off. The fragments were thus held firmly in excellent position. The skin wound was sutured with silver wire, a very small drain of rubber tissue being placed down to the site of the fracture. In this case the mortise was so made that the projecting portion of the lower fragment lay anterior to, and thus rested upon, the projecting portion of the upper fragment. This arrangement is of some importance, as it removes from the bolt a large part of the weight of the leg and counteracts the tendency of the upper fragment to become flexed. At the first dressing, which was made about two weeks after the operation, the wound was found to be very clean and the fragments of bone in good position. The skin suture and drain were removed and the cast reapplied. After this, new casts were applied at intervals of 3-4 weeks, the

wound having been found perfectly healed at the time of the second dressing.

On Dec. 4, 1903, about three months after the operation, it was interesting to note that, whereas a few degrees of lateral motion was possible at the site of fracture, no motion was possible in an antero-posterior direction, namely, in the direction of the shaft of the bolt. On January 10, 1904, the fracture was found to be perfectly solid, no further retentive apparatus being necessary. The patient was very persistent in his efforts to limber up the knee and succeeded wonderfully well. In a very short time he was able to walk on crutches. When he left the hospital his only encumbrance was a poorly-fitting artificial leg on the opposite side. The skiagram, which was taken about five months after the operation, shows the bolt in situ.

In the above case we used a bolt whose shaft was 1 5-8 inches long by 3-32 inch in diameter and whose head was 1-4 inch square by 3-32 inch in thickness. This is a very convenient size and can be used for any part of the shaft of the femur or humerus. For the latter a slightly smaller bolt would be preferable. They can be made by almost any jeweler or instrument maker.

This method is by no means perfect, but was used for want of a better one. It seems chiefly applicable to fractures of the shaft of the femur or humerus and certain oblique fractures of the tibia. Its great advantage is that it apposes the fragments better and holds them thus more securely than perhaps any other method with which I am acquainted.

It has many disadvantages in common with most other mechanical methods of the same general nature. Some of these are:

1. That a foreign body is left in the bone, which may prove a source of irritation and require removal at some subsequent period. With careful technique, I believe this would practically never be necessary. We find that buried silver sutures, even in infected wounds, rarely cause trouble.

2. That the limb is considerably shortened. The shortening, however, is usually a minor consideration as compared with a good useful member, and, as a matter of fact, in a large number of cases of ununited fracture, there is some overriding of the fragments which cannot be overcome, and of which advantage may be taken to secure good apposition.

3. That the bone is weakened by the introduction of the bolt. If this be true, the same objection might be raised to many of the methods now used, in which a foreign body is left in the bone. Most likely there is some compensatory enlargement of the bone at this point.

EXHIBITION OF FOUR APPENDICES VERMIFORMES SHOWING UNUSUAL PATHOLOGICAL CONDITIONS (FROM THE SERVICE OF DR. KELLY).[1]

By C. F. Burnam, M. D.,

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During the past summer four especially interesting appendices have been received at the pathological laboratory of the gynecological department of the hospital. The rarity of the conditions presented is sufficient to make the specimens interesting in themselves, but this interest is greatly added to by a consideration of the clinical facts obtained by inquiry from and observation of the patients from whom the specimens were obtained. I propose, therefore, to give a résumé of the clinical and pathological findings of each case and then to add such conclusions or suggestions as these facts seem to warrant. The group of cases includes one of actinomycosis, one of carcinoma and two of tuberculosis. Two of the cases occurred in the service of the hospital and two were private patients of Dr. Thomas S. Cullen, to whom, and to Dr. Kelly, I desire here to express my thanks for permission to report the series.

Case 1.—Primary Actinomycosis of Appendix. (Gyn.-Path. No. 6961.) Catherine P., bl., æt. 28. Service of Dr. Kelly.

Clinical History:

Past History.—Always well and strong. Has spent most of life on a farm in North Carolina.

Menstrual History.—Regular, q. m. Duration 4 days. Last period just ended on admission.

Marital History.—Two Para, 3 and 2 years. A miscarriage in September, 1902.

Present Illness.—Its onset was in December, 1902, with intense colicky pain in the right lower part of the abdomen. Previous to this there had been no diarrhea or blood in the stools or any symptoms indicating disease of the intestines. This pain lasted a few weeks, but at the end of a week the patient noted at the site of McBurney's point a "swelling the size of a hen's egg." From this point the swelling continued gradually spreading until at the time of her admission to the hospital, May 27, 1903, almost the entire abdomen below the umbilicus was involved. A week prior to her admission a small sinus had opened in the vicinity of the umbilicus and was discharging a purulent-like material. Patient had night sweats and had lost in weight and in strength.

Physical Examination.—On admission patient was noted to be a fairly well-nourished mulatto woman. The lungs and heart on physical examination were normal. No enlargement of the superficial lymph glands was present. Above the umbilicus the abdomen looked normal and on palpation was soft and not tender. The lower part of the abdomen was protuberant and around the umbilicus red-looking. On palpation it was densely hard and gave the same impression as an intramural abscess.

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[1] Presented to the Johns Hopkins Hospital Medical Society, November 2, 1903.

Owing to the thickness and rigidity of the abdominal wall the pelvic examination was found to be quite indefinite. The temperature was irregularly remittent, higher in the afternoon than in the morning. In the beginning it rarely went to 102°. The leucocyte count made at this time was 12,000.

Treatment and Course.—On May 29 a median incision made from umbilicus to symphysis opened a large cavity lying anterior to the recti muscles and containing a necrotic material. The wall, composed of subcutaneous fat and muscle, presented a homogeneous, semi-translucent appearance, being similar to that seen in an omentum infiltrated with carcinoma. Microscopic examination showed in the tissue from the wall the ray-fungus. Healing hardly took place at all, although the temperature went to normal. About the middle of June the patient began to take potassium iodide by mouth and an ointment of the same was applied locally. On June 27 the median incision was again opened and parallel incisions were made along the recti muscles. These incisions were connected by cross-incisions. It was noted that the muscles and all the tissues down to the peritoneum were infiltrated. From this time the induration began to disappear and the incisions to heal, and at the time of death the abdominal wall was almost normal. Improvement continued until July 24, when a pain began in the right lower thoracic region. This onset of pain was accompanied by fever. On August 9, after a chill, the temperature, which had been of an intermittent type, rose to 106°. The leucocytes then counted numbered 5800. The liver dulness was greatly increased and marked tenderness was present over it. A few days before death, August 27, râles, dulness on percussion and other signs of lung involvement, set in. The sputum examined for the ray-fungus did not show it.

Findings at Autopsy.—The abdominal wall, save for scar tissue, was almost normal. The omentum was adherent to the line of incisions along the abdominal wall. A few adhesions were present between the sigmoid and the uterus. The superior surface of the liver was adherent to the diaphragm and in freeing it an abscess in the right lobe of the liver 8 cm. in diameter was entered. A number of smaller abscesses were present in the substance of the liver. An area of softening and necrosis was present in the spleen. Besides these lesions the abdominal viscera were normal save in the region of the ileo-cecal-appendical junction. The lungs were studded with yellowish opaque areas. The pleural cavities contained fluid encysted between layers of adhesions. The brain was not examined. Microscopical examination of these various lesions showed that they were those of actinomycosis.

The appendix lay behind the cecum and ileum. It was not so much a retrocecal appendix as a retro-ileac appendix. It was so densely buried in adhesions as to be discovered with difficulty, and only came clearly to light after dissecting back these adhesions. In doing this several small abscesses were discovered in the adhesions between the ileum and appendix and between the cecum and appendix. The appendix measured about 4.5 cm. in length and 1.3 cm. at base in cross diameter and 1 cm. near apex in cross diameter. On opening the cecum it was found that the appendix pouted into it in an interesting way. On cross-sectioning, the lumen was found greatly narrowed even quite near the cecum. A section at the junction of the inner and middle thirds shows a complete obliteration of the lumen on microscopical examination. The cecal mucosa and wall seemed fairly normal. A section through the appendix quite near its cecal end and passing through one of the small abscesses described, showed a narrow lumen. A surface epithelium, mostly absent (apparently by manipulation); normal-looking crypts of Lieberkühn; a fairly normal interglandular substance, save that an unusual number of small round cells were present; a thickened submucosa, composed of a dense fibrous tissue containing very few nuclei and in which the blood-vessels ran longitudinally; an absence of the lymph follicles; between the submucosa and the circular muscle a small abscess not observed macroscopically containing pus cells and the fungus; a normal-appearing circular muscle coat; and a longitudinal muscle coat which, where present, seemed normal (it had been largely pulled off in the dissecting out of the appendix). The abscess noted macroscopically was in the adhesions but also extends into the muscle coat of the cecum a little way. It contained the ray-fungus in addition to pus cells. A section through the appendix at the junction of the cecal and the middle thirds showed an obliterated lumen. In its place was a granulation tissue. At almost the middle point was a small abscess containing, in addition to pus cells, a giant cell. The fungus was not present. The mucosa was entirely gone.

It may be added here that attempts in life were made to obtain a culture from the abdominal wall, but with negative results. The fungus, as it appeared in the tissue which had been hardened in formalin, cut in celloidin and stained with hæmatoxylin and eosin, showed the central network of threads but the clubs were not obtained.

Considered from the history of its onset and from its clinical course in conjunction with the pathological findings described, it can be definitely concluded that we had to deal with a primary actinomycosis of the appendix which had extended to and involved the anterior abdominal wall and had later metastasized to the liver, lungs, etc.

Among the points of interest clinically observed was the absence of leucocytosis with a high elevation of temperature. The count of 12,000 made on the patient's admission can be explained by a temporary secondary infection, as the abdominal wall abscess was in direct communication with the exterior.

As to the treatment, the observer was impressed that a great deal of real benefit was derived from the potassium iodide, which was given in doses as high as 4 grams t. i. d. by mouth and by an ointment which was rubbed into the abdomen. In this case the treatment which is universally agreed to be the proper one, i. e., the complete removal of the infected area, was, on account of its tremendous extent, impossible. It is possible that if in July, after the abdominal infiltration had greatly subsided and the metastases not yet appeared, we had removed the appendix with the adjacent cecum and ileum, the patient might have recovered. Without an operation actinomycosis of the abdominal wall and intestinal tract is always fatal. Grill's collection gives some idea of operative results: Out of 111 cases, 45 died, 22 recovered, 10 were bettered and the remainder were yet under treatment or had been lost sight of at the time of his publication. Those interested in the potassium iodide treatment will find it excellently considered in Prutz's paper and in the monograph on actinomycosis of Poncet and Berard.

It would seem in our case that metastases had occurred through the blood. Bollinger was the first to show metastases by the lymphatics; later, Ponfick demonstrated the occurrence by the blood.

Hertz in 64 cases of intestinal actinomycosis finds that in all but two the infection had passed the mucosa without leaving a trace; in our case in part the mucosa and lumen of the appendix were both replaced by actinomycotic tissue.

It does not seem indicated to go into the history of the disease in this paper, interesting as such a consideration is. Nor is there anything in the case which adds to our knowledge of the actinomyces itself or the mode of its entrance into and infection of man. These subjects are considered in some of the papers referred to in the literature cited at the end of this paper, that of Poncet and Berard cited above being very good.

While a rare condition, actinomycosis primary in the appendix has been reported a number of times in the literature. This has been well shown by the monograph of Isemer, 1898, who collected 19 cases, and that of Spickenbaum, 1900, who collected 27 cases. Without attempting any further collection, I might add the cases of Ekehorn, 1900; Daske, 1902, Thevenot, 1902, and Letulle, 1903.

Case II.—Primary Carcinoma of Appendix. (Gyn.-Path. No. 6974.) Mr. ——. æt. 25. Private patient of Dr. Cullen.

Clinical Account:

Family History and *Past History* unimportant.

Present Illness.—For two years patient has had recurrent attacks of pain in the right lower quadrant of the abdomen. These attacks have been increasing in frequency and severity. An attack was subsiding at the time of the operation, October 4, 1903. There were pain and tenderness at McBurney's point and the temperature was slightly above normal.

At the operation the appendix was found adherent to the mesappendix at its tip. It was quite red and inflamed-appearing. No enlargement of the mesenteric glands was noted.

The convalescence was rapid and at the present writing the patient is quite well.

Pathological.—The appendix measures 6 cm. in length, 7.5 mm. in diameter at base, and 1.5 cm. in diameter at its tip. The cecal end looks almost normal, while the outer two-thirds of the appendix appears inflamed and adhesions are present upon this part of its surface. On cross sectioning, an apparently normal lumen is seen at the cecal end, a wider one in the middle third, and no lumen in the outer third. The outer 1.5 cm. of the appendix shows in place of a lumen a yellowish core which contrasts with the paler surrounding ring of appendix.

Sections were taken at various levels. That through the cecal end on microscopical examination shows a practically normal appendix. Section from the middle third presents a mucosa intact and fairly normal-appearing. The submucous, muscular, and peritoneal coats show acute inflammation as evidenced by a marked infiltration with polymorphonuclear leucocytes, plasma cells, and exudate.

Sections of the tip show that the yellow core observed macroscopically is a carcinoma which has filled the lumen, has entirely replaced the mucosa and submucosa, has invaded the circular muscle coat, and at one point at least has reached the longitudinal muscle coat. The muscular and peritoneal coats show products of acute inflammation similar to those observed in the middle third of the appendix. The carcinoma cells are arranged in little groups between which run bands of fibrous tissue. The majority of these groups are solid, as is seen in the cell nests of an epithelioma, but here and there a gland type is seen and one can follow the changes from the solid nest to an almost normal crypt of Lieberkühn. The individual cells are polygonal in shape, larger than normal gland cells. The nuclei show considerable irregularity in staining and in size. This tumor can properly be considered as a primary adeno-carcinoma of the appendix.

Several specimens similar to this and also some other forms, as the colloid, of primary carcinoma of the appendix, have been reported. Dr. E. Hurdon reported a case from this laboratory. Kelly, of Philadelphia, in 1900, reported two cases and collected from the literature eleven others. A. W. Elting quite recently reporting three cases of his own, analyzed the entire literature, and after excluding a number of cases where insufficient pathological proof is given, found in addition to his own twenty other authentic cases. As this specimen and the clinical observations clearly suggest, it is probable that the number of such specimens will multiply rapidly with the spread of the practice of careful laboratory study of specimens obtained, not only by operation, but also by autopsy. For it seems credible that most carcinomata in the appendix would sooner or later lead to inflammatory conditions; in case the surgeon intervened soon enough to conditions similar to that in our specimen; if left alone, to those of abscess formation or of general peritonitis. The small primary neoplasm is completely obscured by the large secondary inflammatory process, unless recourse be had to microscopic examination.

The inflammatory process present in this case is an acute one and in the specimen there remains little to suggest previous inflammatory changes. The neoplasm, from its extent and its activity as manifested by cellular changes, would seem to be less than two years old. The history points to attacks over a period of two years. The specimen affords no absolute data by which can be decided as to whether the original attacks antedated the appearance of the neoplasm or not.

From the appearance of the tumor, however, I am inclined to believe that the carcinoma developed in an appendix previously the site of inflammatory changes. To the advocate of early operation in appendicitis, either of these possibilities, i. e., the occurrence of carcinomata in inflammatory appendices or of inflammation of the appendix resulting from cancers, is welcome as no small support to his contention.

Case III.—Primary Tuberculosis of the Appendix. (Gyn.-Path. No. 6825. Miss ——, æt. 28. Private patient of Dr. Cullen.

Family History and *Past History* unimportant. No history of any tuberculosis.

Present Illness.—For about a year the patient had had a dull pain in the right lower quadrant of the abdomen. There had been no acute attacks of pain. No diarrhea or blood had been noted in the stools.

Physical Examination.—At the time of the operation there was no sign of tuberculosis in the lungs or elsewhere on physical examination. Her temperature was normal. At operation the appendix was found very red and had a peculiar "pock-marked" appearance. It was not adherent. The uterus was in retroposition. Otherwise the abdominal viscera seemed normal.

The appendix was removed and the uterus suspended.

The patient made a rapid, uneventful recovery from the operation and is relieved of her symptoms.

Pathological.—The appendix measures 5 cm. in length and 1 cm. in cross diameter. The caliber is pretty constant from end to end. On cross section at different levels the lumen is seen to be present save in the tip 1 cm. The mucosa is thickened, about 2 mm. apparently. Sections were made at different levels.

Microscopical.—The mucosa in some places is intact. In others is entirely replaced by caseous material. The submucosa is infiltrated with tubercular tissue, poorly staining epithelioid cells, areas of caseation, and in some places typical tubercles with a giant cell in the center, surrounded by epithelioid cells can be seen. The circular muscle coat is in places invaded by the tubercular process, but it extends no further, the longitudinal muscle coat and the peritoneum showing no alteration. Tubercle bacilli were readily demonstrable in the sections.

Case IV.—Tuberculosis of the Appendix. (Gyn.-Path. No. 6769.) Mrs. H. ——, æt. 37. Service of Dr. Kelly.

Family History is entirely negative to tuberculosis.

Past History.—For past thirteen years patient has been delicate, being subject to gastralgic attacks. She has had three children. She has had no trouble with menstruation.

Present Illness.—Its onset was in the fall of 1902 with pain in the right lower quadrant of the abdomen. This pain had been continuously present from that time until her admission, June 6, 1903, to the hospital. It varied in intensity and was greatly aggravated during the menstrual periods. There was some history of a chronic cough during the past months. There had been no blood in the stools nor diarrhea.

Physical Examination.—Some enlargement of the glands of the neck; indefinite signs of trouble at the apices; tenderness and muscle spasm in lower abdomen, especially on the right side; a temperature of 100°; a leucocyte count of 12,000; an unsatisfactory pelvic examination, were the important observations on her admission to the ward.

Under ether, the uterus, tubes and ovaries felt normal on palpation, and a diagnosis of probable appendical abscess was made, as a mass could be felt in the region of the appendix.

Treatment and Course.—An incision was made directly over the tumor, which was found to be composed of an adherent mass of omentum, appendix and cecum. No pus was present.

The appendix was retrocecal, the lumen in its outer third was obliterated, in its middle third normal, at the cecal end very narrow. A fistulous opening existed between the middle third of the appendix and the cecum.

The appendix was removed and the openings in the cecum were closed. No tuberculosis was present, macroscopically, on the tubes, ovaries, or elsewhere in the immediate region. The entire peritoneum was not examined, but so far as seen it looked normal.

The incision was drained.

Convalescence was slow; the sinus caused by draining had not entirely closed at the time of her discharge from the hospital. She had an intermittent fever, unaccompanied by a leucocytosis. She had some cough, but no tubercle bacilli were demonstrated in the sputum.

Pathological.—The appendix measured 7 cm. in length and .5 cm. in diameter. Dense adhesions were present on its surface. The condition of the lumen is described above. The mucosa appeared normal.

On microscopical examination the mucosa in a section from the middle third was mostly normal-appearing. In the submucosa on one side was a group of typical tubercles with giant cells in the center surrounded by epithelioid cells. The tuberculosis was mostly limited to the submucosa, but at one point extended almost out to the peritoneum.

Remarks.—Of Cases III and IV it can be said: that Case IV is not a tuberculosis limited to the appendix and probably is not a primary tuberculosis of that organ; that Case III is a primary tuberculosis of the appendix so far as a clinical diagnosis of such a condition is possible. The only absolute way to determine it would be by autopsy. Some light might have been gained by the use of tuberculin after operation, but the patient was never in the hospital and the opportunity to do this was not present.

As has been repeatedly suggested by those who have reported clinical cases resembling Case III, there is no reason why a primary tuberculosis of the appendix should not occur. So far as I know there is no case reported which meets the autopsy standard of proof. It would seem at autopsy that even cecal tuberculosis, which is the commonest variety of intestinal tuberculosis, is rare as a primary or at least as a solitary tubercular condition. Eisenhardt, who is extensively quoted, in 1000 autopsies on tubercular patients, found intestinal tuberculosis 563 times, but in every case there was lung involvement. In no case did he find the appendix alone involved of the intestinal tract. It is by no means to be considered, however, that the failure to find confirmation in autopsies is conclusive against the condition, for it is self-evident that patients who die of tuberculosis will almost certainly have extensive lesions, and therefore it will no longer be possible to locate the primary seat of the disease. On the other hand, the surgeon is not prepared to settle the question. We know well how after the removal of a large tubercular focus, as, for example, the fallopian tubes and uterus, the patient will improve greatly in health and apparently entirely recover, even when there is positive evidence that other parts of the body not removed are tubercular.

It is evident that neither of the patients had extensive intestinal tuberculosis. It seems quite likely that in Case IV the disease in the intestine was limited to the cecum and appendix. The cecum was found somewhat thickened at the operation. Had a diagnosis been certainly made the question of excision of the cecum would have arisen.

Both of these appendices belong to the typical tubercle ulcerative type, in contradistinction to the hyperplastic type as occurs in Crowder's case.

The number of cases of primary tuberculosis, even from the clinical standard, published, is small. A much greater number of appendico-cecal cases have been reported. Among the appendical cases are those of Carl Beck, 2 cases; Karewski, 2 cases; Sonnenburg, 2 cases; Crowder, a case; Potel, a case; Mosher, a case; Josselind Jung, a case.

These cases present the clinical aspects of ordinary inflammations of the appendix, mostly, as in our case, that of a chronic condition. The diagnosis in life would always be doubtful. The indication for a radical operation is greater than that of an ordinary appendicitis. The presence of these cases, as likewise those of primary cancer and primary actinomycosis, make an additional danger in appendicitis to that usually considered and add support to the justification of early operation in all cases.

From theoretical grounds and from comparative results of removal of tubercular foci elsewhere, the results should be good. As a matter of fact they are good, as we find by reading the publication of the results of operative treatment of cecal tuberculosis. It does not fall within the limits of this article to give these results, but I refer those desiring to know them to the excellent consideration of the subject by Professor Mikulicz in the Handbuch der Pract. Chir. of Mikulicz, von Bergman, etc.

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NOTES ON NEW BOOKS.

American Year-Book of Medicine and Surgery for 1904. Being a Yearly Digest of Scientific Progress and Authoritative Opinion in all branches of Medicine and Surgery, etc. Under the general editional charge of George M. Gould, M. D. Surgery. *(Philadelphia, New York and London: W. B. Saunders and Co., 1904.*Q

The temptation, in noticing a book of this sort, is to dismiss it with some facile cynicism about "tabloid literature" and to extend our censure of pre-digested mental food until it includes Dr. Gould and his Year-Book. The merest glance through its pages, however, suffices to show that such an easy commonplace is not in this case pertinent. The book meets an actual demand, and the demand is not for superficial notices, which are primarily readable, but for accurate reviews which are primarily thorough. A good résumé is never easily made, but in this volume this work is always well done; and the book, considering its almost encyclopedic scope, together with its physical limitations, is little short of excellent. It is comprehensive and it is terse; furthermore, it does not bulk unnecessarily, and the material is conveniently arranged. We cannot think of any principle of selection in choosing the articles for review which would meet all demands, but the Year-Book of Surgery for 1904 has certainly given due—some will think, undue—prominence to the American literature; and we doubt if American journals have contained as large a proportion of the medical articles of value as the references in Dr. Gould's book might suggest. Certainly some of the minor characters have a good many lines to speak in this volume, which is somewhat aggravating for busy men who have come to see the star performers.

The Medical Annual. A Year-Book of Treatment and Practitioner's Index. (*Bristol: John Wright & Co.*, 1904).

The Medical Annual for 1904 keeps up the high reputation of the work. The list of contributors is excellent; two are especially well-known here, Mayo Robson, who writes on abdominal surgery, and Dr. Saundby, who discusses renal and urinary diseases. The volume opens with an excellent review of the work in Therapeutics for the past year. The extracts throughout are good, and it is pleasant to see that American literature receives full attention. The illustrations are a special feature of this volume, one set of plates showing the surgical anatomy of the ear and others the skin lesions of acute infections. Everywhere special attention is given to treatment. The work can be highly recommended and should be found very useful by the general practitioner.

The Practical Medicine Series of Year-Books. Vol. II. General Surgery. Edited by John B. Murphy, M. D. *(Chicago: The Year-Book Publishers, November, 1903.)*

This small volume is composed of abstracts of articles which have appeared in the various foreign and domestic journals during the preceding year, and purports to give in this way a fair idea of surgical progress during that period.

The general appearance of the book is unattractive, and the paper and print are poor. These are, however, a very fitting index to the character of the text. There are numerous typographical errors. The abstracts, while fairly well selected, are poorly executed, in fact in many instances the sentences are meaningless jumbles of words. On page 41 we find the following: "Is the average surgical patient actually less in danger from infection if the surgeon wears rubber gloves? First, as to the surgery. Theoretically, the hands need to be resterilized during the operation. Blood serum is, however, a very potent germicide, and this fact is overlooked by most of us." On page 118 this sentence occurs: "Transplantation of tumor cells through so many generations would seem to prove that the life of ordinary tissue cells may, under conditions not realized in one organism, be able to live much longer than the individual to which they belong"; and again, on page 470, the following: "Another condition which leads to quite profuse hemorrhages can be readily recognized cystoscopically, and, besides, profuse hemorrhages are always encountered."

The remarks interpolated by the editor are always concise, lucid and interesting. The book can be hardly recommended to students as an example of correct English construction.

Social Diseases and Marriage. Social Prophylaxis. By Prince A. Morrow, A. M., M. D., Emeritus Professor of Genito-Urinary Diseases in the University and Bellevue Hospital Medical College New York, etc. *(New York and Philadelphia: Lea Brothers & Co., 1904.)*

This volume of nearly 400 pages ought to be read and carefully considered by every physician. It is a model of clear statement and frank advice. Its object is to point out the obstacles which venereal diseases ought to be to marriage and the danger to the health of a wife or an unborn child from them. If all conscientious physicians who are called upon to treat these disorders could be induced by reading the book to give to persons infected with gonorrhœa or syphilis who contemplate marriage the wise advice which reason and knowledge dictate, the number of innocent victims of venereal infection would be materially lessened. The author is not an extremist and writes with moderation, and hence his words should be heeded.

The third section of the book on social prophylaxis will commend itself to all thinking people, laymen as well as physicians. The author evidently favors a legislative enactment to penalize the transmission of venereal disease to innocent persons, although he does not advocate it unreservedly. The true remedy after all is to educate the young man as to the dangers which he will encounter in an unchaste life, and the young woman that it is never safe to marry a licentious man.

Modern Surgery, General and Operative. By John Chalmers Da Costa, M. D. Fourth edition, rewritten and enlarged, with 707 illustrations, some of them in colors. 1099 pages. *(Philadelphia, New York, London: W. B. Saunders & Company, 1903.)*

"The work stands between the complete but cumbrous text-book and the incomplete but concentrated compend. . . The effort has been to present the subject in a form useful alike to the student and busy practitioner."

Such, in brief, is the introduction the author gives to his work. It is an efficient one, protecting him on the one hand from the charge of incompleteness and on the other from that of unnecessary detail. Usefulness of course is the highest attribute to which such a production can lay claim. The large number of text-books of surgery which have just such a scope as the one under consideration is evidence that it is easier to write a useful book than one which can claim for itself accuracy, thoroughness and finish. It seems that by this time we must have enough useful books to supply the demand of students and practitioners, and let us hope that from now on the publications of men of large experience and keen insight may cover a less extended field with more completeness and greater authoritativeness. It is almost necessary, of course, that when one man writes a "surgery" he should take bodily much of the work of other men, and this not always from the original publications, so that by this time the text-books have found, as it were, a dead level, varying little in their treatment and statements, and presenting the hall-marks of much borrowing. Unfortunately in this way the individuality of the author tends to be swallowed up in the necessity he is under of accepting so much of other people's work and indorsing it.

There can be no doubt that Dr. Da Costa has presented a very useful work, and one that has a definite and indicated mission to the large class to whom he addresses it. Like other books it has an operative department. It is hard to conceive what the value of such a section can be. It is impossible that one could learn to operate or could be guided to any extent by the descriptions given of the operative procedures. They are entirely inadequate to be of aid in the actual technique of surgical work. They may possibly aid to a small extent in elucidating the general principles that should guide the operator. It seems, however, that the day must be almost past when the general practitioner would read the description in his text-book before sallying out to do a laparotomy. One expects the surgery of the present day to be done by trained surgeons. There is always room of course for careful descriptions of operations and improvements in methods.

It speaks well of the author that he and his experience and judgment are not lost sight of through the work. As a matter of fact there are few sections where his surgical personality does not show through and redeem the book from mediocrity. For the most part his descriptions and advice as to treatment are complete, and at the same time succinct. There is an unusual faculty in the book of saying much in a small space. Generally subjects are thoroughly covered for all practical purposes and set forth clearly, tersely and with rare good sense and judgment. The writer's individual suggestions seem to us to be the most valuable part of the work. Where he stops to comment on his own experience and surgical habits or to point out among a number of procedures the ones which, in his opinion, are most fitted for given occasions, one is struck with his broad knowledge, thorough principles and excellent discrimination. There are many places where methods of diagnosis and treatment are impartially set forth with a view more to completeness than to urging any particular one, where we would gladly have the author's personal advice. In other words, more of Da Costa and less of time-honored surgery seems to be indicated, or at least desirable.

The book is more up-to-date in its references than most of the other books. There is due appreciation of the work (the American work especially) done during the last two or three years. The writer seems to have taken time to examine the work of other men, and this alone makes his own observations of more value than those of a more self-centered surgeon.

The first section in the book is devoted to bacteriology, and an accurate, practical, concise account is given, with good remarks on antiseptics. The comments on iodoform, its uses and limitations, seem to us to be particularly good. It is recommended for use in abscesses and tuberculous foci, where it is claimed that it stimulates granulation and connective tissue formation, though it is not strictly a germicide. Da Costa says no clinical substitute has yet been found for it. There is a very clear and satisfactory presentation of the important theories of bacteriology, serum therapy, etc. As to the description of the bacteria themselves, the accounts are rather unsuited to surgical application. Not enough stress is laid on the fact that in addition to the ordinary pyogenic cocci many bacilli and cocci, not ordinarily thought of as pyogenic, invade tissues as pus formers.

The chapter on asepsis and antisepsis is very good. It is practical and complete enough and up to date. The remarks on the use of gloves, which he commends, are timely and the advice as to the choice of suture materials presents the almost united views of the best surgeons. Catgut, silk and silver are recommended as the most useful and reliable. In the description of dressings the mistake is made of classing silver foil among the non-absorbable dressings, whereas in reality it is a perfectly absorbable dressing allowing blood and serum to go through into the overlying gauze and almost invariably leaving a dry wound. Surgeons have been curiously slow in appreciating this dressing. There can be little doubt that it is an ideal dressing for most new wounds.

The description of the phenomenon of inflammation and its treatment and of the process of repair of wounds, etc., is modern and practical. There is a very good account of the pathology of the conditions. Little account, however, is taken of the various organisms that give rise to infections, and the differences in the severity of symptoms and the indications of surgical treatment which depends on the organism concerned.

Tuberculosis is discussed quite exhaustively from a surgical standpoint, yet in a concise form. The remarks on the use of tuberculin in diagnosis are rather remarkable in the light of the general modern spirit of most of the book. Speaking of the tuberculin test for purposes of diagnosis purely, he says: "The value of the test is not certain; its results are irregular, a negative result certainly does not rule out positively the existence of tuberculosis; it is not certain that the procedure is absolutely innocuous, and it is certain that the method is entirely useless and possibly dangerous unless employed by a trained and skilful man." This opinion will not hold good, we feel sure, in the face of the rapidly increasing use of tuberculin and the accumulated evidence of its sureness and great value in diagnosis when used judiciously. Its administration is governed by a few simple rules and is practically devoid of bad effects, with a good grade of tuberculin.

One of the best accounts is that of sarcoma and carcinoma. The author seems to appreciate, as not all surgeons of large practice do, the necessity of medical treatment in these conditions. In remarking on the operative treatment of cancer of the breast, however, he simply quotes Halsted's description of his operation and makes no comments on it, but leaves the idea that his own advice would be toward a less complete operation. This is also a little surprising, considering the experience of most clinics.

A subject that has interested surgeons very recently is that of osteomyelitis. Though Da Costa devotes a good deal of space to this disease and presents many useful facts concerning it, still he fails to give a clear account of the pathological development and sequence of the infection; and the remarks on sequestrum formation will probably have to be revised when compared with the recent careful work of Nichols on the subject. The incidence of septicæmia in acute osteomyelitis and its possible causation of the diagnosis of typhoid fever, so frequently made, is not mentioned.

Orthopedic surgery is rather summarily treated with the time-honored remarks and plates that are seen in all text-books.

One of the best sections is that on the surgery of the brain. It is full and clear and the descriptions of the operative methods are excellent, as are the figures describing the topography and surgical points on the skull. Much deserved credit is given to Keen. He recommends trepanation for palliative purposes in the treatment of all forms of brain tumor, whether it is thought possible to remove the tumor or not. Headache, vomiting and the advance of optic neuritis are often checked and the patient's last days passed in comparative comfort. He does not speak of the necessity of very careful closure of the scalp and absolute control of hemorrhage in the wound's deeper parts, to avoid the subsequent possibility of brain fungus—a point much emphasized by Cushing.

Much space is devoted to abdominal surgery. As usual, bone plates, Murphy buttons, various forms of anastomoses, stitches, etc., are greatly in evidence. The various surgical conditions of the peritoneum and organs are well described and little is lacking to satisfy the student or practitioner. On the whole, one would say that the chapters on abdominal surgery are characterized by a conservatism unusual with American surgeons. In fact, many of the procedures have largely been discarded in the past few years for different and usually more direct methods. It is surprising that the author scarcely mentions excision of the gall-bladder in dealing with cholecystitis, gall-stones, etc. Some surgeons would accuse him of being ten years behind the times in his gall-bladder surgery. He is against immediate operation in acute appendicitis, as the rule. In this he would have the support of many eminent surgeons. Space will not allow a more extended discussion of this most important section. It may be said that its excellencies are many. The student will find it an excellent reference-book of unusual completeness and carefulness.

There is one other detail of the work we should like to notice. In dealing with the treatment of hemorrhoids he shows that the Whitehead operation is in great disfavor with him. He says: "Only a surgeon who can master violent hemorrhage should venture to perform it. Primary union is rarely secured. . . . Experience shows that stricture not infrequently arises after its performance, that fecal incontinence occasionally results and that anal anæsthesia with inability to restrain the passage of wind is common." It is quite evident that Dr. Da Costa is not familiar with the Whitehead operation. While it is not the simplest of operations, yet for one who aspires to be a surgeon, it offers no terrors from violent hemorrhage or suppuration or following stricture. Like most other operations it can be done in a right and in a wrong way. With moderate care and the application of ordinary surgical knowledge the hemorrhage is never serious, healing *per primam* is the rule, and stricture the rarest of complications, probably less frequent in this than in the clamp and cautery operation. Fecal incontinence generally lasts two or three days only, and is so rarely a permanent complication that it is hardly considered. An operator so unskilful as to cut the sphincter ani would do poor work in any procedure. The results of the Whitehead operation are most satisfactory when a long series has been studied. The cure is permanent.

Dr. Da Costa's book is worthy of a more extended consideration which space forbids, however. On the whole it will be found a very satisfactory work for the readers to whom it is addressed. The evidence of thoroughly good surgical principles is its best recommendation.

Clinical Talks on Minor Surgery. By JAMES G. MUMFORD, M. D. Small 8vo, p. 115. (*Boston: The Old Corner Bookstore, 1903.*)

This small volume the author modestly states in his prefatory note, deals with "homely, commonplace subjects," that "find little place in the text-book and lend themselves but feebly to brilliancy of demonstration." The ten informal clinical lectures, or "talks," that form the basis of the book deal in a general, common-sense way with subjects such as *incised wounds, granulating wounds and varicose ulcers, felon, whitlow, paronychia, palmar abscess, boils, ingrowing nails*, etc. Though "homely" subjects they are treated in a far from "commonplace" fashion and enlivened, as the chapters are, by frequent historical allusions, by epigrammatic sentences which cling in the memory, all in Dr. Mumford's attractive style, the reader finds that he is able to write "perlegi" at the end of the volume with some disappointment that it is not longer. A third-year student, beginning his acquaintance with minor surgery, will read this little book with the greatest profit; a graduate, with equal interest, and many of them will regret that those simple, everyday subjects were not presented to him in similar graphic fashion in his undergraduate period.

In illustration of the crisp style in which the lectures are delivered one may quote the last lines of one of the chapters: "Don't coquet with a carbuncle. Cut it out as you would a cancer, and you will never regret it." At the time of the demonstration the author suited his words with the action. The scene is readily visualized by the reader. H. C.

The Treatment of Fractures. By CHAS. L. SCUDDER, M. D., Surgeon to the Massachusetts General Hospital. Fourth edition, thoroughly revised, with 688 illustrations. (*Philadelphia, New York, London: W. B. Saunders & Co., 1903.*)

Four editions of this work since it was first published testify to its value. The book is essentially practical, and is intended to serve as a text-book for the student as well as a guide to the practitioner. The various fractures are described in detail and yet concisely, so that the reader gets a good mental picture of the cases. Then, too, each lesion is illustrated not only by photographs of the injured part and of prepared museum specimens, but also by skiagraphs and X-ray tracings. This gives a fourfold aspect of the broken member which greatly assists in the proper treatment.

The chapter on gunshot fractures is especially valuable in that it gives the results of observations made during the Boer war upon the modern high velocity projectiles.

The Rœntgen ray and its relation to surgery, by Dr. Codman, forms another interesting chapter. After discussing its value, Dr. Codman points out the need of skilled interpretation of the negative.

The value of the book is greatly enhanced by the number of extremely good illustrations it contains. The skiagraphs and X-ray tracings are particularly interesting, illustrating, as they do, the various fractures. The book is well worth reading.

The Worth of Words. By DR. RALCY HUSTED BELL. With an Introduction by DR. WILLIAM COLBY COOPER. Third edition, revised and enlarged. (*New York: Hinds & Noble, Publishers.*)

This book is mainly interesting to the physician from the fact that it has been written by a physician and the introduction has been supplied by a brother physician. In the introduction we are informed that "Dr. Bell is a poet—not a mute inglorious Milton, but a songful poet." As, however, no samples are given of the work of this "songful poet" we are compelled to receive the statement for what it may be worth. His little book on the worth of words is interesting and often suggestive, although sometimes marred by slang words and sentimental exuberance.

The Man who Pleases and the Woman who Charms. By JOHN A. CONE. "Look out lovingly upon the world and the world will look lovingly in upon you." (*New York: Hinds and Noble, Publishers.*)

This prettily printed little book of more than 100 pages is full of agreeable commonplaces to enforce the precept that courtesy should be studied as an art. The quotations are appropriate and aid to emphasize the doctrine. A good example is the following: "It is not what you wear in this life, gentlemen, it is how you wear it. It is not so much what you do; it is how you do it."

Howe's Handbook of Parlimentary Usage, Arranged for the Instant Use of Legislative and Mass Meetings, Clubs and Fraternal Orders, Teachers, Students, Workingmen, etc. By FRANK WILLIAM HOWE. (*New York: Hinds & Noble, Publishers, 1904.*)

This is a most handy little manual, and one which cannot help being profitable to a timid or inexperienced chairman. Physicians, as a rule, are indifferent presiding officers and probably stand in need of a manual of this character more than any other persons.

The Complete Medical Pocket Formulary and Physician's Vade Mecum: Containing upwards of 2500 prescriptions, collected from the practice of physicians and surgeons of experience, American and Foreign, arranged for ready reference under an alphabetical List of Diseases. Also a special list of New Drugs, with their Dosage, Solubilities and Therapeutical Applications. Together with formulæ, tables, etc., collated for the use of practitioners. By J. C. Wilson, A. M., M. D., Physician to the German Hospital, Philadelphia. Third revised edition. (*Philadelphia: J. B. Lippincott Company.*)

This is a useful and complete book which ought to be consulted by the physician as well as by the medical student. The formulæ contained in it should not be blindly followed, but rather should be considered suggestive of lines of therapeutics to be employed in given diseases. The book has a recognized place in the library and a definite range of utility.

Les Nerfs du Cœur chez les Tabetiques. A clinical and pathological study. By Dr. Jean Heitz, Ancient Interne des Hôpitaux de Paris. (*Paris: G. Steinheil, Editeur, 1903.*)

The first part of this work is taken up with a detailed résumé of what is actually known of the cardiac plexus, the anatomy and histology of the pneumogastrics and sympathetics and of the plexus itself. As for the physiology, the author has gone especially into the question of cardiac sensibility and the trophic influence of the plexus on the aorta and the myocardium.

The second part gives a complete review of all that has been written on the cardiac symptoms in tabetics. This is followed by the results of a very careful histological examination of the pneumogastrics in four cases, of the sympathetics in six cases, and of the cardiac plexus in twelve cases of tabes. The author shows that in the majority of cases there is a definite lesion in the fibers making up the plexus. Also that there is no causal relationship between these lesions and the aortitis; and that this is not a trophic trouble but should be considered to be of a syphilitic nature.

The singular latency of this form of aortitis in so many cases he thinks to be due to the lesions in the sensory fibers of the cardiac plexus.

Dispensing Made Easy. With Numerous Formulæ and Practical Hints to secure Simplicity, Rapidity and Economy. By Wm. G. Sutherland, M. B. (Aberd.), formerly House Surgeon Queen's Jubilee Hospital, London, etc. (*Bristol: John Wright & Co.; London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd., 1904.*)

This is a plain, practical book, written more for English than American conditions. The directions given are clear and concise. The work will be eminently helpful to all physicians who dispense any portion of their own prescriptions.

The Physiognomy of Mental Diseases and Degeneracy. By James Shaw, M. D., Member of the Medico-Psychological Association, etc. (*Bristol: John Wright & Co.; London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd., 1903.*)

Illustrations of the various forms of mental alienation and degeneracy have a distinct value and a recognized place in medical teaching. The representations of morbid conditions presented in this book are carefully selected and admirably described in the letter-press. The book can be recommended to all students of medicine.

Traité de Radiologie Médicale. Publié sous la Direction de Ch. Bouchard, Membre de l'Institut, Professeur de Pathologie Générale à la Faculté de Médicine. (*Paris: G. Steinheil, Publisher, 1904.*)

This two-volume edition has been written on the plan so frequently seen of late in our various text-books of medicine, each chapter and division being the product of a different author.

Vol. I deals entirely with the technical side of the X-ray and high-frequency currents, each part of an equipment being taken up and discussed at length. In fact, so much detail is given that at times it becomes wearisome. For example, the first 175 pages are devoted entirely to a discussion of electrical currents and their methods of production. In all, about 450 pages are given up to descriptions of the various electrical appliances.

Vol. II consists of about 600 pages, and of this nearly 200 more deal with the method of running the apparatus. The remaining 400 pages deal with the value of the X-ray in diagnosis and therapeutics. In this section probably the most interesting chapter is that devoted to the discussion of "The Diseases of the Chest." The method of examination is described and one is given graphically and concisely the salient features of the various affections.

In the chapter on calculi, the point is well taken that a negative diagnosis does not absolutely exclude the presence of a stone; under certain conditions a soft stone may be present and yet not cast a shadow.

In the treatment of carcinomata and various skin lesions the old question is discussed as to whether burns are due to electrical disturbances or the X-ray. This question has been settled so long that one is surprised that the author should think it necessary to give such a detailed explanation defending his belief that the X-ray alone causes burns.

In conclusion, we may say that the book as a whole is distinctly disappointing. The subject-matter contains nothing new and is simply a reiteration of existing facts, not even especially well presented. The illustrations are few and for the most part not particularly good.

The book belongs more properly to the physical rather than to the medical side of the X-ray.

Infectious Diseases: Their Etiology, Diagnosis and Treatment. By G. H. Roger. Translated by M. S. Gabriel. (*Philadelphia: Lea Bros. & Co., 1903.*)

The author considers first the general character of infectious diseases and of the pathogenic bacteria associated with them, defining an infectious disease as characterized by the phenomena manifested in individuals when undergoing the action of parasitic toxins and reacting against them. Methods of invasion of the organism and the general mechanism of the action of bacteria upon the individual are next discussed, after which the more special subject of the influence of the association of several organisms is taken up. Various special effects of such invasions, suppuration, gangrene, etc., are treated in separate chapters, which are followed by others which describe in more detail the changes produced in the various organs. The mode of onset and development and after-effects of the disease lead to the consideration of the development of immunity and of the efforts which may be made in prevention and cure of such diseases.

Such is in general the outline of a book which is original in that it brings together far more closely than usual the recent acquisitions of knowledge made in the laboratory with the observations of the clinic. Evidently M. Roger is an extraordinarily diligent and acute observer in the laboratory as well as in the clinic, for the amount of material is very great—so great, indeed, that in a short review it would be impossible to speak of special points.

In general it seems that the author's attitude toward the literature, and especially the French literature, is not a very critical one. Results are frequently accepted and stated as facts when confirmatory evidence would add greatly to one's feeling of security. To quote Ribbert, "Man lässt sich dadurch leicht im eine die weitere Forschung hemmende Sicherheit wiegen." Especially irritating are the attempts at the classification of various forms of disease or modes of infection, in which, with the demand for a well-rounded, plausible system so characteristic of the French, elaborate and unnecessary subdivisions and artificial analogies are printed in tables which finally remind one of the lists of phrases in Rabelais.

Nevertheless, the book presents a very interesting survey of the work done in connection with infectious diseases up to a recent period. Doubtless in another edition the chapters on immunity and on special infections will be enlarged to represent the still more modern views. It is particularly interesting in that so much of what is written is based on the work of M. Roger himself and of his pupils.

Diseases of the Skin: An Outline of the principles and practice of dermatology. By Malcolm Morris. (*Chicago: W. T. Keener & Co., 1903.*)

This new edition of Morris' excellent outline of dermatology shows a decided improvement over the old edition of Lea Bros.; the binding is flexible, of a pleasing green color, and seems durable; the paper is of a better quality, the printing clearer, and the symptomatology, etiology, etc., of diseases are separated by black type, which is a very helpful change.

To keep the scope of the book within the limit of an "outline," and allow for much new material, a careful revision of every article was made necessary. This has been accomplished and the volume of the book increased by only fifty pages.

Twelve entirely new articles are added, among which may be mentioned Blastomycetic dermatitis, Von Recklinghausen's disease, Parakeratosis, and Parakeratosis variegata.

It is fortunate that the author saw fit to omit the colored plates of the last edition. Very few had any resemblance to the diseases they represented, and all were disfiguring. A much better idea of the appearance of skin eruptions is conveyed by the numerous photographs and photomicrographs with which it abounds.

A Text-book upon the Pathogenic Bacteria, for Students of Medicine and Physicians. By Joseph McFarland, M. D. (*Philadelphia, New York and London: W. B. Saunders & Co., 1903.*)

Recent progress in bacteriology has made new editions of all our standard text-books on this subject necessary, and Dr. McFarland has just presented us with a third edition of his work. In it he has taken account of the new ideas of both German and French scientists as well as of those of American investigators. The book is especially valuable for its very explicit treatment of the subject of toxins from both the theoretical and practical aspects. In the chapters devoted to the consideration of the chemical constitution and mode of action of the toxins and the antitoxins, he has given considerable space to the exposition of Ehrlich's famous "side chain" theory, not forgetting at the same time Metchnikoff's no less important theory of "phagocytosis." From the practical standpoint as well, the application of these theories to the preparation of the two most important antitoxins—diphtheria and tetanus—has been especially emphasized.

Along with these chapters dealing with toxins and antitoxins, the nature and the action of the whole series of anti-bodies, antirennin, anti-venin, anti-hæmolysin have been carefully considered. Separate chapters are especially devoted to the consideration of each infectious disease, the nature of the etiological factors and the value of remedial agents being carefully discussed. The portions of the text-book dealing with the principles of bacteriology have been considerably enlarged and improved upon, in comparison with the second edition, especially with regard to the very important subject of species differentiation, and several important and valuable charts have been incorporated in the new material.

A new chapter, giving the investigations of Shiga, Flexner and many others, has been devoted to dysentery, and the chapter on yellow fever has been modified so as to accord with the investigations of Reed and Carroll.

Despite a few minor errors, and despite the author's failure to exercise a sufficiently rigid critical judgment, the book is full of valuable information, especially for the medical student, and next to Crookshank's Manual is the best book in English on animal diseases—considered from the standpoint of etiology and treatment, with the possible exception of Moore's recent book on a similar subject.

A Text-Book of Practical Gynecology, for Practitioners and Students. By D. Tod Gilliam, M. D., Professor of Gynecology in Starling Medical College, Columbus, Ohio. (*Philadelphia: F. A. Davis Co., 1903.*)

Conforming with the prevalent practice of writers of text-books on the diseases of women, the author treats of the bladder, kidneys and rectum in addition to those subjects to which the name gynecology can more accurately be applied.

The book is well printed, on good paper, and contains more than 350 illustrations. The arrangement of the matter is systematic. The first chapters are given to a consideration of general etiology, technique at operation, method of examination, etc. The organs are then taken up in anatomical order and considered as to their various pathological conditions. Throughout the treatment is brief, but the frequently associated adjective *lucid* cannot be here applied. Subjects are served up in a very fragmentary way. The book abounds in detached dogmatism, unsupported by reason or authority. Scant reference is made to the literature. In a word, the book is a poor one, and in the opinion of the reviewer contains little to justify its existence, as so many better ones are already available.

Golden Rules for Diseases of Infants and Children. By George Carpenter, M. D. (Lond.), M. R. C. P. Golden Rule Series, No. XI. Second edition, enlarged. (*Bristol: John Wright & Co.; London: Simpkin, Marshall, Hamilton, Kent & Co., Lim.*)

This admirable little book of 167 pages contains a large amount of useful information respecting the disorders of infants and children. This information, it is gratifying to notice, is modern and helpful. Thus, for example, injections of antitoxin are prescribed for diphtheria, an examination of the blood for malarial disease, and an examination of the blood in typhoid fever for the Widal reaction. We regret to see the word enteric fever used instead of typhoid, as tending to mislead the student. A good index serves to render the contents of the volume more accessible to the reader.

A Non-Surgical Treatise on Diseases of the Prostate Gland and Adnexa. By George Whitfield Overall, A. B., M. D. (*Chicago: Marsh & Grant Company, 1903.*)

This monograph is another example of the alliance, frequently if not always unfortunate, between medicine and applied physics; for when one sees the pages of a book studded with such words as "cataphoresis," "electric osmosis" and "sinusoidal," the mind naturally reverts to Perkinism and the previous as well as the subsequent systems of mechano-therapeutics which have careered, like comets, into medical history and, like comets, have careered out again into the night. Not that the devotion of Professor Overall (A. B., M. D.) to physical therapeutics has biased his mind away from drugs. The pharmacopeia he knows with something of a lover's intimacy. Oil of gurgin, extract of triticum—all the rarer herbs and simples which the ordinary practitioner will do well to have heard of—Dr. Overall knows not only by name but by dosage; and it would seem that the catholicon, for which prostatic surgeons have waited so long, would sooner have been available if the power of drugs when joined, in the mystic bond of "cataphoresis," to the powers of electricity, had not been overlooked. Dr. Overall is an exponent of "no-knife" medicine. He appreciates—possibly it would be well if his colleagues in practice also appreciated it—the very satisfactory results to be accomplished in prostatic cases by massage diligently and intelligently used over long periods of time. Without taking too hostile an attitude to Dr. Overall's generally safe and conservative position, we would, however, say that, if the question became a personal one, the knife would fill us with less horror than the prospect of having a prostate "hammered at" (the expression is his own) "through rectum and urethra until the indurated tissue begins to soften, then atrophy."

Ueber die Bedeutung der funktionellen Nervenkrankheiten für die Diagnostik und Therapie in der Gynäkologie. Von Professor B. Krönig (*Leipzig: Erlangen. Verlag v. Georg Thieme, 1902.*)

Krönig has limited himself entirely to functional nervous diseases which he includes under neurasthenia, hysteria and hypochondriasis. He calls attention to the fact that although the ancient view that the pelvic organs were entirely responsible for the development of hysteria and neurasthenia has been abandoned, yet we cannot deny that they bear a very intimate relation to the functional nervous diseases. This view is held by both neurologists and gynecologists.

In Part I, under the heading "Diseases of the genital tract secondary to a primary mental disturbance," he includes: 1. Sudden cessation of menstruation due to fright. 2. Sudden starting of the flow due to fright. 3. The so-called nervous or phantom pregnancy occurring after a single cohabitation.

The author says: "Die Hysterie nimmt gern die Larve einer Organerkrankung an." As an example of this it is pointed out that hysterical or neurasthenic patients often present symptoms identical with those due to inflammation of the uterus and appendages. In other words, they resemble them identically, although on pelvic examination no abnormality can be detected. He also draws attention to the pain in the left ovarian region so common in hysterical or neurasthenic individuals—"Charcot's ovarian hysteria." These patients have often consulted many physicians previously and come with a diagnosis of inflammation of the ovary. Krönig agrees with Lomer that such cases of ovarian neuralgia are to be classed under hysteria and that this ovarian pain is due to a central disturbance.

He speaks especially of hysteralgia of the vaginal portion of the cervix, the pain also involving the vaginal vault, the mere touching of the parts giving rise to violent hysterical attacks.

Endometritis dolorosa (hyperesthesia of the endometrium) he considers one of the signs of hysteria. Vaginismus, according to Krönig, is a symptom-complex. It may return after confinement, after resecting the hymen or splitting the constrictor muscle, may still persist with a relaxed outlet and on the whole yields a very poor prognosis.

The author says that great care must be exercised to exclude organic lesions before rendering a diagnosis of hysteria in these cases. He draws attention to the fact that under ordinary circumstances the cervix and a large portion of the vagina can be removed, the patient complaining of very little pain.

Krönig describes in detail those nervous cases where there is much tenderness over the lower abdomen and the patient feels that "everything is dropping out" and yet on examination no lesions exist. He also points out that many patients fall into the hands of the gynecologist instead of the neurologist. Consequently on the former rests the responsibility of deciding whether the backache and pelvic pain are due to disturbances of the sexual organs or whether they be secondary to a general neurosis. A thorough examination of the entire nervous system is necessary.

Under vaso-motor trophic disturbances with normal pelvic structures, long cessation of the period and painful profuse menstruation are considered. Krönig says that the nervous character of such menorrhagia and metrorrhagia is shown in the fact that local treatment is often ineffectual while a general building up yields the looked-for improvement. Reports are given where from fright the menses ceased permanently. Krönig thinks that many cases of dysmenorrhea have a purely hysterical basis.

The second portion of the book is given up to treatment of these cases. We note with much pleasure that in so-called erosions, lacerations of the cervix, misplacements of the uterus and cases of "small cystic ovaries" he advocates building up the patient first, in the hope that no operation may be necessary. By isolation of the patient in a hospital, suitable diet, massage, exercise of various kinds and particular attention to the patient's mental impressions he has in many cases obtained excellent results without any treatment of the local condition. It is gratifying to note that the treatment outlined is based on that outlined by one of our most distinguished countrymen, Dr. Weir Mitchell, of Philadelphia. Krönig describes it in detail and expresses in the highest terms its value in many cases. In a goodly number of cases it is of course necessary to combine an operative procedure with the rest treatment.

Rarely has the reviewer undertaken the perusal of a medical book with greater reluctance. First he feared that the many contradictory symptoms in this class of cases gave little hope of an elucidation of the subject, and second, he knew that the group of patients which try the ingenuity of the physician almost beyond endurance is composed of those who suffer from supposed functional nervous phenomena attributable to the pelvic organs. The work under consideration has been written by a man peculiarly fitted for the task, thoroughly grounded in pathology and bacteriology and with a large clinical experience. We had reason to expect a well-rounded, clear and unbiased consideration of the subject and have not been disappointed. It is high time that many members of the profession appreciate that the distressing train of nervous symptoms referable to the pelvis are not often due to the so-called cervical erosions or to slight lacerations of the cervix and that the perfunctory local applications to the cervix for supposed "ulceration of the neck of the womb" or the repair of slight lacerations of the cervix be abandoned and the Weir Mitchell treatment or a modification of the same be adopted.

The work of Krönig is a most timely one. It embraces not only his own experience, but also gives a complete *résumé* of the subject. Not only should it be read by the gynecologist, but also by every physician. Thus many women who would otherwise come under the gynecologist's care can be satisfactorily relieved without the necessity of calling in the aid of the specialist, or will come under his care only as a last resort.

The Practice of Medicine. A text-book for practitioners and students. By James Tyson, M. D., Professor of Medicine in the University of Pennsylvania, and Physician to the Hospital of the University. Third edition, thoroughly revised. With 134 illustrations, including colored plates. (*Philadelphia: P. Blackiston's Son & Co., 1903.*)

Appreciative reviews of the two previous editions of this work have appeared in the pages of this journal. The present third edition does not tend to lessen the high regard in which this book has been held by all familiar with it, but rather to increase our conviction of its excellence. It has become one of the standard text-books in medicine used by English-speaking students, and quite justly so.

In the present edition numerous small changes and additions have been made, without, however, increasing the size of the book or modifying to any extent its general plan. As probably our knowledge of the infectious diseases has undergone the most rapid change during the past few years, so the greatest number of changes are to be expected and are to be found in this section. The excellent chapter on typhoid fever was commented on in the review of the first edition. Among the additions to this chapter it is unfortunate that the author has failed to mention the marked effect of the typhoid poison on the blood-vessels, to which a number of observers, especially the French, have lately drawn attention. This is also omitted in the discussion of arteriosclerosis; in fact, none of the acute infections are mentioned as playing any rôle in the production of this condition. Also, no mention is made of the diagnostic importance of the isolation of the typhoid bacillus from the blood, urine and fæces. These procedures, cultures from the blood at least, in hospitals, or even in private practice, do not offer very great difficulties, and in many cases are of great value in early diagnosis.

That the chapter on dysentery has been reviewed by such an authority as Dr. Flexner is in itself proof that the very latest ideas in regard to this condition are presented.

We think that most of those who have had large experience with diphtheria do not quite agree with the author in their treatment of this disease. The present tendency is to give very large doses of anti-toxine, many insisting that from 7000 to 10,000 units should be given at the outset, even to cases of moderate severity. Undoubtedly many practitioners have been employing too small amounts. This, however, is a somewhat debatable point.

In the diagnosis of the various forms of meningitis (aside from cerebro-spinal fever) we do not think the author has laid sufficient emphasis on the value of lumbar puncture—under the diagnosis of tuberculous meningitis it is not even mentioned. The statement made in the chapter on cerebro-spinal fever that in tuberculous meningitis the fluid obtained by lumbar puncture is clear, requires some modification.

These criticisms, however, most of them directed toward small errors of omission, are simply similar to those which might be presented in regard to any book of so comprehensive a character as this. The remarkable feature of the book is that it contains so much, not that something has been omitted.

As in the second edition, the chapter on nervous diseases has been revised by Dr. Spiller, and both in arrangement and matter the standard of the remainder of the book is maintained.

It is a great pleasure to review such an excellent text-book, which presents to the students so clearly a summary of our knowledge of disease.

Clinical Treatises on the Pathology and Therapy of Disorders of Metabolism and Nutrition. Part IV. The Acid Antitoxins. By DR. CARL VON NOORDEN, Physician-in-Chief to the City Hospital, Frankfort-a.-M. (*New York: E. B. Treat & Co., 1903.*)

This little book is disappointing. Instead of a general discussion of the subject the author has limited himself quite strictly to his own ideas of diabetes.

A Pocket Book of Clinical Methods. By CHAS. H. MELLAND, M. D., Lond., M. R. C. P., Physician to the Ancoats Hospital, Manchester. (*Bristol: John Wright & Co.; London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd., 1903.*)

This little book was certainly intended for the pocket. It is small, the pages number but seventy-five, with a few additional blank pages for memoranda. A few clinical methods are briefly described. The author seems to think that few are valuable. We cannot agree with him concerning his tests for free HCl in gastric contents, because of the slight value he places upon fresh blood examinations, as well as the orthography of eosinophil, neutrophil, etc.

The book has little value and is a source of danger to the student who is inclined to be lazy.

Surgical Anatomy and Operative Surgery. For Students and Practitioners. By JOHN J. MCGRATH, M. D., Professor of Surgical Anatomy and Operative Surgery at the New York Post-Graduate Medical School, Visiting Surgeon to the Harlem Hospital, etc. 559 pages, with 227 illustrations, including colors and half-tones. (*Philadelphia: F. A. Davis Co., 1902.*)

In the preface the author states that he has endeavored to combine in a practical manner the subjects of surgical anatomy and operative surgery, excluding as far as possible all anatomical considerations not of practical value in the performance of these operations. It is evident at a glance that the author of this volume has undertaken an almost impossible task when he attempts in this limited space to describe the operations of general surgery, even in a very condensed form, especially since more than two hundred of the pages are taken up with surgical anatomy and diagrams. Many of the descriptions are exceedingly concise but in several instances are considerably aided by the diagrammatic plates.

The book is divided into ten sections, the first being an unsatisfactory outline of anæsthesia, and a few general considerations. In the sections which follow, the surgical anatomy of each part is given, more or less at length, preceding the description of the operations, which for the most part are much too brief to be of use to one not thoroughly familiar with surgical procedure; for instance, the operations on the liver and gall bladder, including the surgical anatomy and diagrams, are given in eighteen pages.

Looking through the book we are struck by the omission of many important operations, among them thyroidectomy, for aneurysm, operations on the heart, for umbilical hernia, the high operation for varicocele, on the ureters, for osteomyelitis and others, both old and new.

Plastic operations on the face are considered quite fully, and most of the modern methods of intestinal anastomoses are taken up.

The usual ligatures, amputations and excisions are described briefly, but no mention is made of gynecological operations or those of the special branches.

There is as a rule no advice as to the operation of choice when two or more are described, and taking it all in all, the book is too incomplete for either students or practitioners to depend on entirely.

The American Year Book of Medicine and Surgery for 1904. Being a Yearly Digest of Scientific Progress and Authoritative Opinion in all branches of Medicine and Surgery, etc. Under the general editorial charge of George M. Gould, M. D. Medicine. (*W. B. Saunders & Co., 1904.*)

The volume for this year keeps up the usual standard of excellence. A new feature is a short summary for each department of the more noteworthy advances during the year. These are short and well done. There is no possibility of a minute review of a work such as this. We can only express our appreciation of its value and the excellent way in which it is prepared.

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OBSERVATIONS ON TWO CASES OF TUBERCULOUS PERICARDITIS WITH EFFUSION.

By WILLIAM SYDNEY THAYER, M. D.

Associate Professor of Medicine in the Johns Hopkins University, Baltimore.

CASE I.—*Tuberculous pericarditis. Large effusion. Paracentesis of the pericardium in the 5th space about 4 cm. within the mamillary line.*

W. E. H., aged 26. Family history, in no way remarkable. Father, living and well. Six brothers and sisters, in good health. One sister died in infancy.

The patient is a curtain hanger by occupation, of regular habits and good previous history. He has had none of the serious illnesses of childhood and considered himself perfectly well until the spring of 1898, when he had a left-sided pleurisy with effusion, which kept him in bed for a month. In the spring of 1901, he had a similar attack again of a month's duration.

Three or four weeks ago while dressing, he leaned over to pick up one of his shoes and fell to the ground in a faint. He soon recovered consciousness but felt weak and "giddy" and sent for a doctor who advised him to stay at home. About a week later he began to suffer from shortness of breath, and gradually with increasing dyspnœa, there developed a fulness in the præcordial region. The patient was under the charge of Dr. Fenby, who recognized the presence of a pericardial effusion and advised aspiration.

On the 31st of October, I saw the patient in consultation with Dr. Fenby. He was in bed lying on the left side. There was marked dyspnœa. The expression was anxious, the lips, somewhat cyanotic. The pulse was of small size and low tension, irregular and intermittent, uncountable at the wrist. By stethoscope, about 150 beats could be made out to the minute. The respirations were shallow, 50 to the minute.

There was a marked bulging of the whole præcordial region. The movements of the chest were rather more extensive on the right than on the left. The cardiac impulse was inappreciable on inspection or palpation.

On *percussion* the cardiac dulness was enormously increased, beginning above in the first space, extending outward to the nipple line on the right, and to the left away beyond the nipple into the posterior axilla. The cardiac flatness was also greatly increased, reaching the hepatic flatness at about the mamillary line on the right and on the left far out in the mid-axilla. On the left it began above at the second place.

At the left apex the resonance was somewhat dull and tympanitic. On the right there was also a distinct tympanitic quality, though the sound was clearer. In the back there was slight dulness at the left apex, while elsewhere the note was more tympanitic than on the right side.

On *auscultation* a few fine râles were heard at both bases, while at the left apex the respiration was enfeebled, the breezy quality of the inspiration was lost, and medium and fine, rather sticky râles were heard on inspiration.

In the whole præcordial region the heart sounds were almost absent; entirely so below the fifth rib. Above, they were so extremely feeble and distant that nothing definite could be determined as to their character.

It was decided to aspirate immediately. The patient was placed in a chair in a semi-recumbent posture, and a point for aspiration was selected in the fifth space about two fingers' breadth inside the mamillary line. It seemed wise to aspirate at this point in order to establish better drainage than could be obtained by seeking a point nearer the sternum. The danger of striking the heart was deemed to be slight on account of the fact that careful auscultation seemed to definitely indicate that the apex was at a higher point. The history and character of the case were such as to leave little doubt that the effusion was serous, and the danger of infecting the pleura seemed relatively slight. The trocar was introduced at this point and slowly advanced obliquely backwards and toward the median line. Immediately on its introduction, the fluid spurted out with a force indicating that it was contained under considerable pressure. 1250 cc. of almost clear, yellowish, straw-colored fluid were withdrawn. At the end of this time the rate of the pulse had materially diminished although there were frequent intermissions. By moving the trocar upwards the heart could at times be felt and the rubbing of the end of the trocar against the visceral pericardium resulted in the withdrawal of a few drops of blood. During the aspiration the respirations gradually became quieter, the dyspnœa diminished and finally almost disappeared. At the end of aspiration the respirations were 28 to the minute, as compared with a rate of 50 at the beginning.

On *percussion* of the heart after the withdrawal of the trocar, the flatness to the right of the sternum was found to have completely disappeared, the lung having come back into place. The relative dulness, however, still preserved a somewhat triangular shape, the angle between the cardiac dulness and hepatic flatness on the right side remaining obtuse. On the left, the flatness ended at a point inside the nipple line and the cardiac impulse was well felt in the 4th space or about under the fifth rib, just inside the nipple. There was also visible pulsation in the third space. On *auscultation*, the heart sounds at the apex were loud and accompanied by a very slight to-and-fro pericardial friction which was well heard over the right ventricle, along the sternal border and at the base. The second pulmonic sound was somewhat accentuated. The pulse remained rapid, between 130 and 140, but was regular and of much better size and tension.

About a month later, on the 21st of November, the patient who had steadily improved, called at my office with Dr. Fenby. At that time he looked rather pale though the mucous membranes were of fairly good color. The pulse was rapid, about 130 at the beginning of examination, in great part, probably, the result of excitement.

On physical examination the left upper chest was found to be distinctly flattened, while the motion on respiration was also slightly deficient.

Heart.—There was marked pulsation in the second, third and fourth left interspaces and over the whole præcordial area. The apex impulse was in the fourth space, 10 cm. from the median line, just inside the nipple. Dulness began at about the second space and extended 5 cm. to the right of the median line. *The angle between cardiac dulness on the right and the hepatic flatness was acute, the dulness showing the normal curved outline.* There was no flatness to the right of the sternum and no dulness outside of the point of maximum impulse. At the apex the impulse was of moderate intensity, while over the base there was a well marked diastolic shock. The first sound was clear at the apex, the second, reduplicated during inspiration. In the pulmonic area the second sound was reduplicated during the latter part of inspiration. Otherwise the sounds were clear. There was no friction murmur.

Lungs.—At the apex of the lung on the left side, the note was duller than on the right; the vocal fremitus was of about equal intensity on the two sides. The respiratory murmur on the left was rather enfeebled; expiration prolonged. Numerous fine and medium moist râles were audible after cough; these were heard throughout the front. The right side was absolutely clear.

In the back, the right side was clear throughout on percussion and auscultation. On the left, there was slight dulness with enfeebled respiration in the supra-spinous fossa where fine râles were heard on cough; elsewhere, clear. There was no Broadbent's sign.

8-vii-1900. In response to a letter the patient called to-day. He says that he has felt rather weak but has been at work off and on since the fall, working steadily through January, February, May and June. In December his voice became so hoarse, that he could barely talk aloud, and his inability to work steadily has depended entirely upon this trouble, as he has been unable to make himself properly heard. He consulted Dr. Warfield, who discovered that there was paralysis of the left vocal cord. Later, another laryngologist told him that he had an ulcer upon one of his vocal cords.

His appetite is good and he weighs as much as usual, 125-128 pounds.

The patient looks better than when last seen, though his voice is very hoarse. The color is good; tongue, clean. Pulse, at beginning of examination, 25 to the quarter.

Lungs.—Thorax, somewhat flattened in the whole upper left front above the nipple; perhaps a little so in the axilla. Expansion somewhat deficient on that side. Percussion note, somewhat deficient above the fourth rib on the left; clear on the right. Vocal fremitus, more marked on the right. On quiet breathing the respiration is a little puerile in the right front with slightly interrupted inspiration above the clavicle. On the left there is a tubular modification of the respiration; the inspiration is softened and less breezy than usual; expiration, prolonged. Below the fourth rib the respiration is normal. Occasional fine râles above the right clavicle, after cough. Numerous fine and medium moist râles above the fourth rib in the left front, exploding after cough. Vocal resonance, increased. Slight dulness over the upper lobe in the left back with the same rather enfeebled and slightly modified respiration and fine râles. Otherwise the breathing is clear throughout.

Heart.—There is well marked visible pulsation in the second, third and fourth left spaces, extending outwards nearly to the mamillary line. There is no retraction at the apex. On palpation the shock of the second sound in the pulmonic area is well felt. The point of outermost impulse is clearly localized, visible and palpable in the fourth space 8½ cm. from the median line. The relative dulness begins in the second space and extends obliquely outward to this point. On the right it has a distinctly round outline extending at its farthest point, at about the lower border of the fourth cartilage, 4 cm. from the median line. The cardiac flatness begins at the fourth rib, extending obliquely outward to the point of maximum impulse. On deep inspiration the lung comes down so as to almost cover the cardiac flatness. There is no flatness beyond the left sternal border. The cervical veins are scarcely visible; no diastolic collapse.

At the apex the heart sounds are perfectly clear beyond a slight reduplication of the second sound which is heard during inspiration. In the tricuspid area the sounds are clear excepting for this reduplication for several beats with inspiration; the second part of the reduplication is accentuated. In the pulmonic area the sounds are clear. In the second left space the second sound is sharply accentuated. On inspiration this sound is reduplicated during several beats, the second part of the reduplication being accentuated. In the second right interspace the second sound is sharp but not nearly as much so as in the pulmonic area. The same reduplication is heard during inspiration, but the first part of the split sound is accentuated, clearly showing that the reduplication is due to pulmonic delay. There is no indication of Broadbent's sign. When the patient lies on the right side, the apex impulse remains practically *in situ;* the limits of dulness on the right side do not move. When the patient lies on the left side, the position of the apex impulse changes but little. The actual difference in the position of the point of maximum impulse with change of position, is only about 1 cm., measuring about 8 cm. when the patient lies on his right and 9 when he lies on his left side. Blood pressure (Riva Rocci) 123 mm.; temperature 98.7°.

9-vii-'03. The patient called to-day on Dr. Warfield who sent me the following note. "Mr. H. called this morning and I find that his larynx has changed since I first saw him. Then the left cord was paralyzed, but now in addition, both cords are thickened and covered with fine superficial ulcers which are clearly tuberculous. The ulcers are very superficial and there is very little infiltration outside of the cord. * * * * "

27-xi-'03. The patient called to-day in answer to a letter. He has been feeling quite well and working steadily since the last note. He has but little cough; does not know his weight.

He looks like a different man. The color of the face, lips and mucous membranes is good. Tongue, clean. Pulse, regular, of good quality, 94. The size and pressure are fair; the vessel wall is not palpable.

Lungs.—The thorax on inspection shows a well marked flattening of the left front and also a slight retraction of the whole side, with diminished expansion, particularly in the upper part of the front. The vocal fremitus is more marked in the upper left front and there is slight dulness in the first three spaces; little or no dulness below the third rib. On quiet respiration the inspiratory murmur, on the right side, is rather harsh and slightly wavy. On the left side there is a slight tubular modification of the respiration which is enfeebled, occasional medium moist râles being heard during inspiration. Occasional fine and medium râles are also heard throughout the front. On deep respiration and cough there are fine moist râles just above and below the right clavicle and throughout the left upper lobe, more marked at the apex. Throughout the rest of the right front and the lower lobes on both sides, the respiratory murmur is clear.

Heart.—There is a wide area of cardiac impulse seen in the second, third, fourth and fifth spaces and over the fifth rib. The whole chest in the præcordial region moves. The point of maximum impulse in the apex region is to be felt, 8.7 cm. from the median line in the fourth space, dulness extending 4.7 cm. to the right. On standing, the impulse becomes distinctly more marked and clearly defined. This point is relatively fixed, being 8 cm. from the median line when the patient lies on the right, 10 when he lies on the left side. On inspiration the lung descends a little in the præcordial region, but scarcely more than a finger's breadth, flatness beginning at the fourth rib on expiration, in the fourth space on inspiration. When the hand is placed over the præcordium or the apex, two impulses are felt. At the apex the stronger, more deliberate impulse, that resembling the shock associated with the ventricular contraction, is synchronous with the protrusion at the point of outermost impulse. On auscultation, however, it becomes evident that *this impulse is diastolic and not systolic; that the whole præcordium is retracted with systole, rebounding with diastole in such a manner as to simulate an ordinary cardiac impulse.*

The first sound at the apex is of moderate intensity; the second, associated with the impulse, is slightly reduplicated. This reduplication is heard all over the cardiac area, most markedly in the pulmonic region. The separation between the two parts of the sound is increased on inspiration—clearly a reduplication due to pulmonic delay. In the tricuspid, pulmonic and aortic areas, the first sound is of moderate intensity but clear. The second pulmonic is louder than the second aortic sound. There is no trace of Broadbent's sign.

The more interesting features of the case are:

(1) The large amount of fluid obtained on aspiration.

(2) The subsequent development of paralysis of the left vocal cord, due undoubtedly to sclerotic changes in the mediastinum following involvement of lymphatic glands or extension of the tuberculous process from the pericardium or lung.

(3) The gradual development of the signs of adherent pericardium.

(4) The completeness of the recovery after so extensive an effusion.

CASE II.—*Tuberculous pericarditis. Large effusion. Aspiration in the 6th left space at the sternal border and in the left costo-xyphoid angle, unsuccessful, the needle coming immediately into contact with the dilated heart. Death. On autopsy the enlarged and dilated heart was not adherent to, but contiguous with the anterior wall of the pericardial sac, the fluid, over 1200 cc., lying posteriorly and at the lateral angles.*

R. C. W., aged 59, a German saloon keeper, was admitted to the hospital at half past twelve o'clock on the first of September, 1903. The patient's complaint was of weakness and shortness of breath which had been coming on gradually for several years. The respiratory distress had greatly increased during the preceding few days. No previous history could be obtained.

The following note was made by Dr. Cole. "Moderately well nourished, muscles flabby. At the time of examination the patient is lying flat with the head slightly propped up; looks very ill; considerable cyanosis of the lips, ears and finger tips. Respirations, 10 to the quarter. The patient is coughing occasionally; frequent expiratory grunts. The pupils are small; react well to light. Tongue dry, slightly coated. * * * Veins of the neck are very full. No marked pulsation of deeper vessels. No general glandular enlargement. Chest; expansion fairly good, equal. Considerable respiratory distress. Resonance, clear throughout right front and axilla and left upper front, but note is markedly impaired in the lower left axilla and in the lower left back up to the angle of the scapula. On auscultation, on the left, the breath sounds are clear throughout the upper front and upper back except for a few râles in the interscapular space. Below, they are very distant, practically absent at the extreme base excepting just at the angle of the scapula, where they are a little harsher and the suggestion of a pleural friction is occasionally heard. On the right side the breath sounds are quite clear throughout, except in the lower back where there are mucous râles and the breath sounds are distant.

Heart.—Point of maximum impulse is neither visible nor palpable. Over the entire præcordium no impulse can be felt. There is a very wide area of absolute dulness. The relative cardiac dulness begins at the middle of the third rib, extending to a point 16.5 cm. to the left in the 5th interspace, when the patient lies on the right side. When on his back, however, the limits of dulness are difficult to make out as they extend well out into the axilla. On the right side the dulness extends apparently 7 cm. outward in the fourth interspace, the angle between the upper limit of liver dulness and the cardiac dulness being very obtuse. There is definite præcordial bulging, though the intercostal spaces seem no fuller than on the right. At the apex and over the entire præcordium no impulse can be felt. At the apex and over the entire præcordium the heart sounds are barely audible until one reaches almost the costal margin in the fourth and fifth interspaces where the sounds are faintly heard. A to-and-fro friction murmur is also audible over the sternum from the third to the fifth rib. The murmur sounds superficial, louder during expiration than inspiration; not apparently increased by pressure of the stethoscope; it sounds suspiciously pericardial in character but not definitely so. The heart's action is of almost fœtal rhythm. The sounds are heard more loudly in the second interspace, neither aortic nor pulmonic being especially accentuated. The pulse is very small; it can hardly be counted. The abdomen is full; no movable dulness in the flanks; feet and legs markedly œdematous."

At 5.45 P. M. I saw the patient with Dr. Cole. He was at that time prepared for paracentesis of the pericardium. At my suggestion Dr. Cole adopted the method advised by Delorme and Mignon.[1] The patient was placed in a semi-recumbent position, and an incision about 2 cm. long was made at the left sternal margin at the level of the sixth interspace, ethel chloride having been used previously to deaden sensation. A small trocar was then inserted in the angle between the ribs as close to the sternal margin as possible. This was introduced vertically to about the depth of the sternum, then tilted so as to pass under the sternum and finally inserted carefully into the pericardium, the needle pointing downward, inward and to the right. After withdrawing the rod a small amount of bloody fluid escaped. On inserting the trocar further the rubbing of the heart against the end could be distinctly felt. On withdrawing slightly a few cc. of clear fluid escaped and then the flow stopped. This procedure was repeated several times, each time with a similar result. A Potain aspirator was then attached to the trocar but only a few cc. of fluid were obtained, the tube soon becoming stopped. This was repeated several times, the trocar being moved in different directions but without result. The rubbing of the heart against it was often felt. An aspirating needle was then inserted upward and backward through the left costo-xyphoid angle, but again only a few cc. of fluid were obtained; not more than 40-50 cc. in all were removed. Owing to the patient's moribund condition it was thought best that no further efforts be made.

I was unfortunately obliged to leave before the end of this procedure and witnessed only the first attempt at aspiration.

At *autopsy* the pericardium was found to be markedly distended. The distension, however, extended more to the left than to the right; a large sac-like projection almost filling the left axilla. There was also considerable distension to the right. The heart lay almost directly against the anterior wall at the point where the needles had been inserted. On inserting the needle of a large syringe in various directions above and to the right and left of the heart, about 800 cc. of fluid were removed, and after opening the parietal pericardium about 400 cc. more escaped.

From the position of the heart at autopsy it could be seen that the aspiration had been attempted at almost the worst possible place. Dr. Cole observes in a note made after the autopsy: "The fact that the heart sounds were heard loudest over the sternum and along the left sternal margin together with the fact that the friction rub was audible here, should have led me to insert the needle either to the right of the sternum or far to the left outside of the mamillary line."

The pericardium contained about 125 cc. of slightly turbid dark, thick, firm, yellow fibrinous exudate. This was rough and shaggy and in many places rounded in the form of ridges. The outer surface of the pericardium on the left, showed many small yellow tubercles, averaging about 2 mm. in diameter.

The heart was greatly enlarged and rather soft, the surface, covered with a mass of fibrinous exudate similar to that seen on the parietal surface of the pericardium. The right ventricle was considerably dilated. The aortic valves were thickened and sclerotic. At their base, on the superior and inferior surfaces were numerous small tuberculated calcareous masses. The superior edges of the valve were connected with the aortic ring by many firm fibrous bands. The valve must have offered obstruction to the blood stream. Nothing remarkable in the other valves. The heart muscle was of a dark reddish color and very soft. The papillary muscles showed numerous fibroid patches. The coronary arteries were rather tortuous and showed many small, raised yellow plaques.

The left pleura contained about 700 cc. of slightly turbid, straw yellow fluid. Both lungs contained numerous small areas of tuberculous broncho-pneumonia. The bronchial and tracheal glands were enlarged and caseous.

These cases have seemed to me worth reporting for various reasons. The former chiefly on account of the amount of fluid obtained by aspiration, the latter because of its bearing upon the question as to the position of the point of greatest advantage for aspiration in pericardial effusions.

THE SIZE OF PERICARDIAL EFFUSIONS.

The amount of fluid which the pericardium may contain is enormous. Verney[2] extracted 900 cc. of fluid from the pericardium of a young man of 23, on two occasions separated by an interval of three days. At autopsy, twenty-three days after the first puncture, the pericardial sac contained over 4000 cc. of yellowish fluid. It is not rare to find from 800 to 1000 cc. of fluid in the pericardium. The largest effusions are, however, usually purulent, and records of the evacuation of from 1- to 2000 cc. of pus are not extremely rare. The largest amounts of which I have found record are in several Russian cases mentioned in West's interesting article.[3] In three of these cases four and a half, five and five and a half pounds of blood, respectively, were removed from the pericardium. These were all cases of scorbutus which ended in recovery. In but few instances, however, has the removal *intra vitam* of a greater quantity of serous fluid been reported than in our first case.

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[1] Rev. de chir., 1895, xv, 797; 987; 1896, xvi, 56.

[2] Gaz. hebd. de méd., Paris, 1856, iii, 793.

[3] Med. Chir. Tr., Lond., 1883, lxvi, 235.

Indications for Paracentesis of the Pericardium.

Although aspiration of the pericardium is a relatively simple procedure, it is not one which is frequently demanded even in large effusions.

Delorme and Mignon[4] observe wisely that "The opening of the pericardium should be reserved for those cases only where the *limits of the tolerance of the heart are passed or the phenomena of cardiac adynamia begin to appear.* . . . Great dyspnœa, irregular and rapid pulse, extensive præcordial dulness, difficulty in appreciating the heart sounds demand intervention, whatever may be the duration of the symptoms and acuteness or chronicity of the affection."

Diagnosis of Pericardial Effusion.

There can rarely be serious doubt as to the existence of a pericardial effusion in instances where it is large enough to produce symptoms calling for interference, and yet mistakes have been made even in such cases. Rotch[5] some years ago, demonstrated clinically and by injections of cocoa butter into the pericardium, that the presence of fluid in the pericardial sac results early in the appearance of flatness in the fifth right intercostal space, contrary to what is usually the case in dilatation or hypertrophy of the heart. But flatness in the fifth right space *may* be present under these latter circumstances.

The essential point in distinguishing extensive cardiac hypertrophy with or without pericardial adhesions, from fluid in the pericardial sac was pointed out in 1896 by Ewart,[6] who called attention to the fact that it is not the extent or shape of the area of cardiac *flatness* (absolute dulness) which is important. This, of course, represents the amount of pericardium uncovered by air-containing lung, and may naturally depend upon a variety of circumstances. The important point is the shape of the area of *dulness* (relative dulness). The pericardial sac full of fluid always has a more or less triangular shape, and the area of pericardial dulness extends obliquely outward on the one hand to the splenic flatness or the lower limit of pulmonary resonance, and on the other to the hepatic flatness. The right side of the heart, however hypertrophied it may be, always has a curved outline corresponding to the shape of the right auricle, and this curved outline it is possible to make out in most instances by careful percussion. The angle between the relative dulness of the heart and the line of flatness of the liver is thus an acute angle corresponding to the shape of the right side of the heart. If, however, there be fluid in the pericardium the shape of the non-resonant body—the pericardium filled with fluid—which lies in part beneath the lung, is triangular, and the angle between the dulness over the pericardium and the flatness of the liver will be an obtuse angle. Careful attention to this point serves to distinguish good-sized effusions from cardiac hypertrophy where the anterior border of the right lung may be so far removed from the sternum as to cause flatness in the fifth right space. It is, moreover, especially valuable in the recognition of very early and slight collections of fluid in the pericardium.

A large proportion of errors in diagnosis in thoracic affections depends upon the lack of attention to the tedious minutiæ of careful percussion of the chest. Those who, in obscure cases of thoracic trouble, take pains to mark out with a pencil the lower limits of the lungs and the outlines of cardiac dulness will often save themselves serious trouble. Accurate diagnosis in thoracic disease demands time, familiarity with theories and methods of physical exploration and some power of reasoning—and I am not sure that time is not the most important of these elements.

Method of Procedure in Paracentesis of the Pericardium.

Much has been written with regard to the point of election for aspiration of pericardial effusion, and there has been a surprising difference of opinion. On general principles it is best to aspirate at that point at which the most perfect drainage may be obtained. There are, however, several dangers which one commonly seeks to avoid. These are: (1) Infection of the pleura. (2) Injury to the internal mammary vessels. (3) Puncture of the heart.

(1) *Infection of the Pleura.*—Under antiseptic precautions and in ordinary sero-fibrinous pericarditis there is little danger in puncturing at such a spot that the trocar or needle traverses the pleura on its way to the pericardium. This is often true even in purulent pericarditis. There are, however, cases in which puncture of a purulent pericarditis through the pleura has resulted in a serious spread of the infection. Thus in the case of Vaillard,[7] in an individual with pericardial effusion following typhoid fever, 600 cc. of greenish brown pus was withdrawn from a puncture in the fifth space about 6 cm. from the left sternal border. Two hours later there was severe pain in the lower left axilla with the rapid onset of a left-sided pleurisy which was followed by death.

It may, however, be an extremely difficult matter even in large pericardial effusions, to avoid the pleura, as has been demonstrated by the interesting observations of Delorme and Mignon. It is commonly assumed that the border of the left pleura passes the sternal margin at about the fourth space, and leaves a small area of pericardium uncovered at the sternal end of the fifth left interspace. Delorme and Mignon, however, found the left border of the pleura to be contiguous with or beneath the sternum—

In the 4th space, in 17 out of 32 cases.
In the 5th space, in 12 out of 32 cases.
In the 6th space, in 6 out of 26 cases,
or nearly one-quarter.

It is then, by no means always possible to avoid the pleura by puncturing vertically inwards at any point along the border of the sternum.

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[4] Rev. de chir., Par., 1895, xv, 802.

[5] Boston M. & S. J., 1878, xcix, 389; 421.

[6] Brit. M. J., 1896, i, 717.

[7] Quoted by Delorme and Mignon, *op. cit.*, p. 1013.

(2) *Injury to the Internal Mammary Vessels.*—There is little danger of injuring the mammary vessels if one introduce the needle in any interspace at a point immediately contiguous to the sternal border or four centimetres to the left. In 30 cases Delorme and Mignon found that the distance between the sternal border and these vessels varied,

In the 4th space, from 3-20 mm.
In the 5th space, from 2-30 mm.
In the 6th space, from 3-40 mm.

(3) *Puncture of the Heart.*—The possibility of puncturing the heart should always be seriously considered; yet the danger following this accident would appear to be slight. There is record of a considerable number of cases in which the right ventricle has been punctured without serious result. In several instances, however, death has followed, as in the case of Callender[8] in which the trocar was introduced in the fourth left space. Two ounces of blood were removed; five minutes later death occurred from hemorrhage into the pericardium. The right ventricle had been perforated in the middle of its anterior surface. In Baizeau's[9] case, which is usually regarded as one of puncture of the heart, the needle was introduced in the 5th space three fingers' breadth from the sternal border. Air entered the pleura, and about 400 cc. of dark blood was obtained. Death occurred two hours afterwards. At autopsy the pleura and pericardium contained blood. Baizeau, however, expressly denies that the heart was wounded.

Shapojshnikov[10] mentions a case reported by Southey where death resulted from a wound of the heart in connection with puncture.[11]

Position of the Heart in Pericardial Effusion.—The only method by which we can be sure to avoid puncture of the heart is to insert the needle at a point below its lower border or outside of the apex. Despite much discussion, the relations of the heart to the chest wall in cases of large pericardial effusion are not entirely settled. It is probably true as pointed out by Rendu[12] and Ferrand[13] that in large pericardial effusions the heart, retained in place by the great vessels, remains practically in its normal position while the diaphragm descends. A much more difficult and still unsettled point, however, is the relation of the heart to the anterior chest wall. Many, especially German observers who have followed Skoda,[14] have been inclined to believe that the heart tends to fall backwards on account of its greater specific gravity. The observations of Shapojshnikov[15] suggest that this is not the rule, but that in most cases, even in very large effusions, the heart remains close to the anterior wall of the pericardial sac. This Shapojshnikov has determined to have been the case in a number of instances under his clinical care, while experimentally, after injection of the largest possible quantities of fluid, he found but a very thin layer between the heart and anterior wall of the pericardium. He especially emphasizes the fact that in very large effusions a friction rub may still be present.

Our second case is a striking example in point. With over 1200 cc. of fluid, the visceral and parietal pericardium were still adjacent anteriorly.

Point of Election for Aspiration.—In view of these facts what then is the best point at which to introduce the needle? According to West,[16] aspiration of the pericardium, while suggested by Riolan in the 17th century, was first practised in 1819 by Romero of Barcelona, but it was not until about the middle of the last century that the operation was other than of the greatest rarity.

Aran,[17] one of the earliest to practice aspiration of the pericardium, sought the spot at which the heart sounds were least audible, in the 5th space, 2-3 cm. from the outer limit of flatness.

Baizeau[18] advised aspiration in the fifth space as close as possible to the sternum, seeking thus to avoid wounding the mammary vessels and the diaphragm. He advised making a small incision at the end of the fifth space through which he introduced the trocar. While yet in the mediastinum the needle should be removed and the canula pushed inward until it is arrested by the pericardium. By the sensation communicated to the canula one should be able to determine whether it is resting upon the pericardial sac containing fluid or the right ventricle itself. This determined, the trocar is further advanced and a puncture made. At this point, however, there is unquestionably danger of puncturing the heart.

Dieulafoy[19] advises another method. The patient is raised slightly in bed and the needle is introduced in the fourth or fifth space, best in the fifth, 5 or 6 cm. from the left border of the sternum. The needle, connected with a vacuum already produced in the aspirator, is pushed very slowly upwards and inwards. After it has passed for a distance of from 3 to 6 cm., one ought to reach the pericardium or heart. As soon as the fluid begins to come the needle is swung in such a manner that it may lie in a position parallel to the ventricle.

The puncture at this point has two objections: (1) danger of puncturing the heart; (2) the certainty of puncturing the pleura.

Others have recommended puncturing below the seventh rib in the angle between it and the base of the ensiform cartilage. If, however, the diaphragm be but little depressed while the dilated heart lies anteriorly, as is apparently the rule, this is by no means a favorable point for aspiration and the needle may enter the heart before any fluid is obtained.

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[8] West: Med. Chir. Tr., Lond., 1883, lxvi, 275.

[9] Gaz. hebd. de méd., Paris, 1868, 2 s., v., 515, 562.

[10] Russk. arch. pat. klin. med. i bakt., St. Petersburg, 1896, ii, 75.

[11] The reference given by S. is " Société royale de médecine et de chirurgie de Londres, 24 Avril, 1893." Careful search has failed to reveal the original.

[12] Mém. Soc. méd. des hôp., Par., 1882, 86.

[13] *Contribution a l'étude de la paracentese du péricarde, 4°, Bordeaux, 1882, 5. s, No. 3.

[14] Abhandlung über Perkussion und Auskultation, 8°, Wien, 1842, 2. Aufl., 295.

[15] *Op. cit.*

[16] Med. Chir. Tr., Lond., 1883, lxvi, 235.

[17] Gaz. d. hôp., Par., 1855, xviii, 517.

[18] Gaz. hebd. de méd., Par., 1868, 2 s., v, 515, 562.

[19] Traité de l'asp. des liquides morb., 8°, Paris, Masson, 1873, 279.

Rendu[20] asserts that if one observes a gradual descent of the diaphragm during several successive days, he may safely puncture in the mamillary line about one centimetre above the lower level of flatness which may be in the 5th, 6th or 7th space.

It is easy to imagine that a large liver might be a confusing element in such a case.

Delorme and Mignon,[21] after a careful consideration of the subject, advise the following procedure: About one finger's breadth above the lower border of the seventh cartilage, at the sternal margin, a cutaneous incision is made of about 4 cm. in length, exposing the fifth and sixth spaces. In the sixth, unless that space be too narrow to allow the introduction of a needle, and if this be the case in the fifth, or very exceptionally in the lower and internal part of the fourth space, a needle, best No. 2 Dieulafoy, is introduced at the sternal border, and passed slowly, vertically inwards. As soon as the needle has entered to the depth of the sternum, that is, about 8 mm., it is turned obliquely inwards so that the point may follow the posterior surface of the bone. After it has entered about 1 or 2 cm. the extremity is lifted slightly and the needle introduced obliquely inwards and downwards by a slow continuous movement until fluid enters. This, the authors believe, avoids as far as possible injuries to the pleura as well as to the heart.

But our second case shows how unsatisfactory this method may be, even in the presence of a very large effusion.

Shapojshnikov,[22] as the result of a careful series of observations and experiments, concludes that it is not always possible to determine the position of the heart before tapping. As a rule it is to be found close to the anterior wall of the pericardium; it does not fall downwards and backwards, as Skoda and others have believed.

If, then, one introduce the needle in the fourth or fifth left space close to the sternum, he has chosen a position in which it will be particularly difficult to avoid the heart. In very large effusions, where the diaphragm is depressed and the semilunar space occupied by flatness, Shapojshnikov advises aspiration in the sixth left space. Where this is not the case he prefers introducing the needle in the third or fourth right space close to the sternum, provided there be flatness at that point. In all cases Shapojshnikov advises an exploratory puncture with the hypodermic needle. This procedure serves two purposes, (a) to determine the character of the effusion; (b) to ascertain the position of the heart. If the fluid be purulent, aspiration should of course be replaced by incision and free drainage.

Shapojshnikov observes, with apparent reason, that with proper care there is no danger of injuring the heart by such preliminary exploration. If the physical signs be deceptive and the heart, which was supposed to lie wholly above the point selected for aspiration, be really just behind this spot, its movements will be readily felt by the hypodermic needle.

Shapojshnikov has never known pleurisy to follow such an exploratory puncture, and in justification of the measure refers to the frequency and impunity with which exploratory punctures of the liver are made in cases of suspected abscess.

* * * *

When we consider these various methods it seems to me that the procedure advised by Shapojshnikov is the most rational. It is by no means always possible to escape the pleura by tapping in the fourth or fifth left space close to the sternal border, while from every other standpoint this is a most unfavorable point, especially in view of the fact that the heart is usually close to the anterior wall of the pericardial sac. The method advised by Delorme and Mignon may fail, even in very large effusions, as has been demonstrated by our second case. If, then, we abandon the attempt to avoid the pleura, the best place to aspirate should be that in which the drainage would be most perfect. In cases where the apex cannot be localized, where there is no reason to suspect that the heart extends beyond the left mamillary line, the 6th space, at about the mamillary line, would appear to be the point of greatest advantage. It would seem best not to introduce the needle too far out, in order to allow for retraction of the sac. If it be definitely determined that the dilated heart extends beyond the mamillary line, one would then seek a point a little outside of the supposed position of the apex.

Aspiration should always be preceded by exploratory puncture. Should the heart be found directly behind the point selected for aspiration, it may well be wise to follow Shapojshnikov's recommendation and introduce the needle in the 4th right space close to the sternum, provided there be flatness on percussion at that point. If the needle be introduced downwards and to the right there ought, owing to the conformation of the right auricle, to be little danger of injuring the heart.

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[20] *Op. cit.*

[21] *Op. cit.*

[22] *Op. cit.*

THE RELATION BETWEEN CARCINOMA CERVICIS UTERI AND THE BLADDER AND ITS SIGNIFICANCE IN THE MORE RADICAL OPERATIONS FOR THAT DISEASE.

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The relation between carcinoma cervicis uteri and the bladder manifests itself clinically in the anterior extension of the disease, thus involving the bladder, and with the necrosis of the cancerous tissue a vesico-vaginal fistula is formed. Other clinical manifestations of this relation present themselves in the frequency of accidental injuries to the bladder in the operative treatment of this disease, there having been 19 such injuries in 157 hysterectomies for carcinoma cervicis uteri in this hospital; and also in the frequency of cystitis following these operations, suggesting that the operation must be considered an accessory etiological factor in its origin.

It is evident that hysterectomy alone cures this disease in but a very small percentage of the cases, because at the time of the operation the growth either by direct invasion or by metastases has involved other parts. From a review of our cases, made in October, 1902, we found that in three-fifths of the patients admitted to this hospital the growth had extended beyond operative treatment, and that after a period of three years only 23 per cent, and after a period of five years only 11.+ per cent of the cases were free from recurrence. The extension of the growth into the parametrium with especial reference to its relation to the ureters and the bearing of this relation on the more radical operations have been studied and published,[1 2 3] as well as the efficiency[4] of the periureteral arterial plexus, the effect[5] of freeing the ureters from their pelvic sheath, and the results of ureteral necrosis, as well as the etiological factors[6] in the causation of ascending renal infection. These studies have taught us that it takes but a very slight involvement of the parametrium either by direct extension or metastases, for the growth to reach or extend beyond the ureters and that in these operations the periureteral arterial plexus should be preserved, whether one resects the ureters or dissects them from free, for an injured ureter is a very important etiological factor in the causation of lowered renal resistance and hence renal infection. The more one studies this disease and its invasion of the surrounding tissues the more one is impressed with the importance of a wide excision of the primary growth, especially in the early cases, for in these there is the greatest chance for a cure and the patients are in good condition to stand the more radical operations. The high percentage of local recurrences also shows the necessity of this procedure.

The object of this paper is to see what may be learned from anatomical, experimental and clinical studies as to the indications and feasibility of sacrificing portions of the bladder in these more radical operations.

Relation between the Cervix Uteri and the Bladder under Normal Conditions.

The following observations were made in order to determine the relation between the cervix and the bladder in different positions of the uterus.

Case I.—Nullipara. Age 27. Gyn. No. 11,151. Patient complained of pain in the right side and backache; both kidneys were found to be freely movable, the right more so than the left; and the uterus was in retroposition and situated to the right of the median line. In order to determine the source of the pain a cystoscopic examination was made and both ureters were catheterized and fluid injected into them in order to see if the pain caused by the injection of this fluid was the same as that from which the patient suffered, thus indicating whether the pain was renal in origin or not, as has been described by Dr. Kelly.[7] The patient was first examined in the Sims' posture,[8] with slight elevation of the table, the bladder dilated well on removal of the obturator from the cystoscope. The urethra was found to be 3.8 cm. long and the distance from the external urethral orifice to a line drawn between the two ureteral orifices was 5.8 cm. and the ureteral orifices were 2.4 cm. apart, and in this position apparently were equally distant from a line bisecting the pelvis. The outside of the cystoscope had been marked in centimeters and half centimeters so that the distance from the external urethral orifice to various parts of the bladder could be read directly on the instrument by pushing the cystoscope into the bladder until the end reached the part to be measured. The distance between the two orifices was measured by swinging the end of the cystoscope from one orifice to the other and determining how many diameters of the cystoscope the orifices were apart. Other methods of measuring these distances have been described by Dr. Kelly.[9] The distance from the external urethral orifice to the cervix, which in this position was found to the left of the median line instead of the right, as in the dorsal position, was measured with a uterine sound and found to be 6.2 cm. The patient was then examined in the knee-breast posture and similar measurements taken and both ureters catheterized. In this position the cervix was found to be 7.5 cm. from the external urethral orifice instead of 6.2 cm. as found in the Sims' posture. On making a bimanual pelvic examination with the patient in the dorsal position the uterus was found in retroposition, to the right of the median line and freely movable, and by placing traction forceps on the cervix, it was possible to draw the cervix almost down to the vulvar orifice and push it in various portions of the pelvis, yet these positions, unless extreme, did not appreciably affect the trigonum of the bladder or the ureters, as could be easily determined by the pelvic examination. The trigonum and ureters were relatively immovable as far as the fixed structures of the pelvis were concerned, and the relation of the uterus to these structures was dependent on the position of the uterus in the pelvis. See Fig. I, which is a diagrammatic representation of the findings in this case.

Case II.—Para I. Age 44. Gyn. No. 11,133.

Diagnosis.—Very large dermoid cyst of the right ovary, densely adherent to the uterus and dragging the uterus out of the pelvis so that the cervix was pulled to the right of the median line and situated 11 cm. from the external urethral orifice.

Bladder was examined in the knee-breast posture and found to be only very slightly displaced by the tumor, as indicated in Fig. II, emphasizing that the relation between the uterus and the ureters and trigonum is dependent on the position of the uterus in the pelvis and that displacements of the uterus unless extreme change but very little the relation of the ureters and trigonum of the bladder to the fixed pelvic structures. I have made similar observations and measurements in the Sims' and knee-breast postures of six other cases and they all showed that the relation of the cervix to the ureters and trigonum of the bladder was altered by the position of the uterus in the pelvis.

These relations were studied still more satisfactorily in the pelvis of a multipara a few hours after death. Catheters were inserted in the ureters from above and the bladder was opened so that the trigonum could be observed. A bimanual examination was now made with one hand in the pelvis and the other in the vagina. The uterus was displaced by pulling it up in the pelvis, drawing it down, and displacing it to the right and left side. While extreme displacement in any direction would also displace the ureters and trigonum, one could see that the relation between the cervix and these structures was dependent on the position of the cervix in the pelvis.

The surface of the cervix rests against the posterior surface of the bladder and the two organs are united to each other with fibrous and adipose tissue, which allows of some play between them and permits of an easy separation of the two organs. The area of the bladder attached to the cervix is situated posterior to the trigonum, namely, that portion of the bladder which is relatively mobile as compared with the trigonum. The size of the vesical area varies in different cases, and with the position of the uterus in the pelvis and degree of distension of the bladder. When the uterus is in anteposition the uterus may rest against the bladder for a considerable distance, as shown in Fig. III; on the other hand, when the uterus is in retroposition this area may be much smaller, as shown in Fig. IV. Also in the distended bladder, this area is greater than in the contracted bladder, for as the bladder distends, the uretero-vesical peritoneal fold is pushed up and a greater portion of the bladder lies in contact with the uterus, while the reverse takes place when the bladder contracts. As has been stated, the uterus is attached to the bladder, posterior to the trigonum and in the different positions of the uterus it is the portion of the bladder between the trigonum and the cervix which helps adapt itself to these positions of the uterus. The distance between the cervix and the ureteral orifices may be but 3 or 4 mm. in one position and when the uterus assumes another position this portion of the bladder and vagina will stretch and the distance may be 1.5 or 2 cm. (see Fig. I), or even as great as 4.5 cm. (Fig. II), and yet the trigonum has been but very slightly altered by these changes. A result of these studies is well shown in Fig. IV, which is a reconstruction made from cross sections of a woman's pelvis where the uterus was in the right side of the pelvis in adherent retroposition, and one can see that both ureters are similarly situated as far as the fixed pelvic structures are concerned and that the relation between the cervix and trigonum and ureters is dependent on the position of the uterus in the pelvis and as the uterus in this case is in the right side of the pelvis, in retroposition, only a small part of the bladder is attached to the cervix and the cervix is much nearer the right than the left ureter and is situated posterior to the right side of the trigonum so that the middle of the cervix is directly back of the right ureteral orifice.

Relation between the Growth and the Bladder.

The cervix rests against the posterior bladder wall and as soon as the growth extends through this portion of the cervical wall, it is in contact with the bladder. On the other hand the rectum does not become involved as readily, for the *cul de sac* is situated between the cervix and the rectum (Fig. III). The rectum can be directly invaded by the growth only when the cervix becomes adherent to the rectum, the two layers of the *cul de sac* being thus adherent and permitting an extension of the growth from the cervix, or else the vagina may become involved and the growth reach the rectum below the cervix. Whether or not the bladder becomes involved will depend on the origin of the growth, the direction of its invasion, and also its extent. A growth beginning in the cervical canal would have to extend through the entire anterior cervical wall before it would reach the bladder (Figs. VII and VIII). It is difficult to see why in some cases the growth extends in one direction and in another case in an entirely different one. In the case represented in Fig. IX the growth is restricted entirely to the anterior wall of the cervix and, while the posterior cervical wall is compressed and displaced, it has not been involved by the growth. It becomes evident from a study of the anatomical relation between the cervix and the bladder that the bladder is soon involved in these cases, for it rests against the cervix and vagina and the growth does not have to extend far either through the cervix or vagina before it reaches the bladder. The portion of the bladder involved is apt to be that part which rests against the lower portion of the cervix, *i. e.*, where the growth is not only so apt to start but also to directly invade surrounding tissue (Figs. VIII, IX and XI). This portion of the cervix is also unfortunately the part nearest the ureters, and here it takes but a very slight extension anteriorly to involve the bladder and one laterally to involve the ureters (Fig. XI). On the other hand, the upper portion of the cervix is not as intimately connected with the bladder and here the ureters are further from the cervix, and also the growth may not be as extensive at this level, for it is usually further from the starting place. On this account both the bladder and the ureters may not be involved at this level until late in the extension of the disease (Fig. X; compare with Fig. XI).

Effect of the More Radical Operations on the Bladder.

In hysterectomy for carcinoma cervicis uteri, not only is the entire uterus removed, but also a portion of the vagina. The amount of the latter removed varies with the extent of the disease and also with the operator, some operators removing more than others. The posterior surface of the bladder is exposed and injured in freeing it from the cervix and vagina. The greater the difficulty in freeing the bladder the greater the chance for injury to it, and also of leaving cancer tissue attached to the bladder wall. The area of bladder thus exposed and injured varies with the amount of bladder attached to the cervix, which has been discussed, and also with the amount of vagina removed. If one removes a cuff of vagina 2 cm. wide, the upper portion of the trigonum will usually be exposed, while a cuff 3-4 cm. wide may expose the entire base of the bladder down to the internal urethral orifice besides the portion of the bladder attached to the cervix which extends as far up on the fundus of the bladder as the utero-vesical peritoneal fold. In the specimen represented in Figs. V and IX a vaginal cuff only about 2 cm. wide was removed and yet an idea of the amount of bladder exposed may be gained by studying Figs. XIII and XIV, where one may see that almost the entire posterior surface of the bladder down to the internal urethral orifice has been exposed and injured. In this case the patient died on the 9th day from ascending renal infection and the bladder was obtained at autopsy and the illustrations made from these specimens. It becomes evident that a large portion of the bladder is exposed and injured in these operations in such a manner that the function of the bladder is interfered with and that the bladder is predisposed to infection, the amount of injury varying with the area of the bladder exposed and the amount of trauma caused in freeing the bladder, which in turn would depend on whether the bladder was adherent or not.

In freeing the bladder from the cervix, parametrium and vagina, not only are vessels going to this portion of the bladder destroyed, but vessels in the outer vesical wall are also injured, thus interfering with the nutrition of the bladder and impairing its function and predisposing it to infection.

The blood supply of the bladder is frequently injured in other ways by the operation, *i. e.,* in the ligation of large vessels, as the internal iliac or its anterior branch from which arise the vesical arteries. I am unable to see any operative advantage to be gained in the ligation of these vessels over the ligation of the uterine alone, and there is certainly this disadvantage that the blood supply of these parts must be injured, thus making them less resistant to infection.

Experimental Work Demonstrating Some of the Etiological Factors in the Causation of Cystitis.

During the last year I have made several experiments on dogs in regard to ascending renal infection, using bouillon cultures of *Staphylococcus pyogenes aureus* as the infective agent.

I. In 8 dogs the organism was introduced into the jugular vein and the ureter of one kidney was ligated. In every instance the organism was excreted by the kidneys and obtained from the bladder. Yet in not a single instance did a cystitis develop. On the other hand, the kidney whose ureter was tied became infected, while the other organ did or did not escape, depending on the virulence of the organism, individual susceptibility, etc.

II. In 9 dogs the lower end of one ureter was resected and the ureter implanted in the bladder, and 10 cc. of a 24-hour bouillon culture of the organism was injected into the bladder with a hypodermic syringe. The dogs were killed in from 4 days to 6 weeks and renal infection occurred in 3 of the 9 cases and in these cases there was a marked stricture at the seat of the implantation. On the other hand, except for areas of infection about the silk sutures, used in the uretero-vesical implantation, the bladders were free from any evidence of cystitis except in one case, in which there was a small localized area. These experiments only emphasize that injury in addition to infection does not necessarily cause cystitis.

III. In 4 dogs one ureter was ligated and 2 to 3 cm. of it was excised between the ligature and the bladder, and the vesical end of the cut ureter was also ligated. The bladder was incised and the mucosa injured and in places removed, care being taken not to injure the ureteral orifices. A small rough stone was now placed in the bladder and the incision closed. Ten cc. of a 24-hour bouillon culture of *Staphylococcus pyogenes aureus* was injected into the bladder. One dog was killed on the 6th day. In this instance the organism was regained from the circulated blood, liver, gall bladder, urinary bladder, and both kidneys, and there was a pyonephrosis of the kidney whose ureter had been ligated. Apparently, a general infection had arisen from the bladder, and the kidney whose ureter had been tied became the seat of a pyonephrosis. The other three dogs were killed at the end of two or five days and all cultures except those from the bladder were sterile. Even in these cases the bladder withstood very well the infection and rough stone. There was some evidence of cystitis, but less than I had supposed would occur. These experiments have been previously referred to in an article published on ascending renal infection.[6]

IV. In 5 dogs the blood vessels of the bladder were injured by ligating the main vesical artery, which arises from the uterine arteries, and also by tearing some of the vessels on the surface of the bladder by means of a fine pair of forceps; 10 cc. of a 24-hour bouillon culture of *Staphylococcus pyo-*

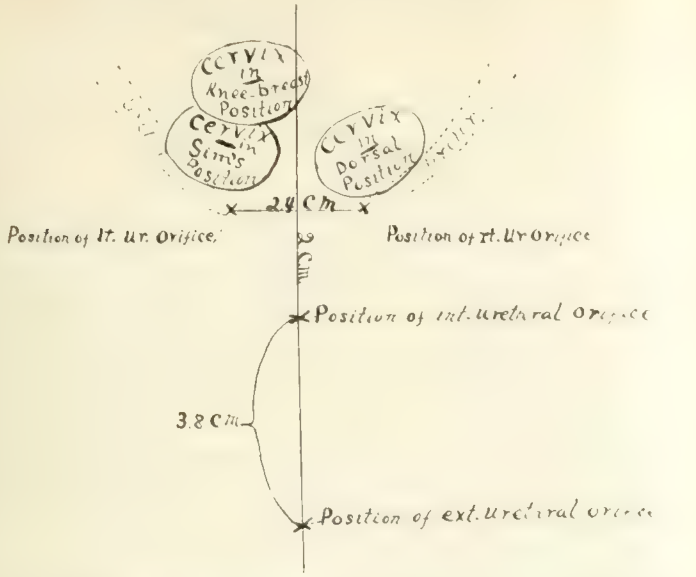
Cervix in Knee-breast Position
Cervix in Sims's Position
Cervix in Dorsal Position
2.4 Cm
Position of lt. Ur. Orifice.
Position of rt. Ur Orifice
Position of int. urethral orifice
3.8 Cm
Position of ext. urethral orifice

FIG. I.—RELATION BETWEEN THE CERVIX AND THE TRIGONUM OF THE BLADDER IN DIFFERENT POSITIONS OF THE UTERUS. × 7/10.

Nullipara, age 23. Uterus in retroposition, in right side of the pelvis when the patient was in the dorsal position. Cystoscopic examinations were made in the Sims and knee-breast postures and the length of the urethra and dimensions of the trigonum were determined in these positions. The ureters were catheterized with silk bougies and the position of the cervix was noted in the Sims, knee-breast and dorsal postures of the patient. The catheterized ureters could easily be palpated and relation of the cervix to them was determined.

This illustration is a diagrammatic representation of the findings in the case, as marked out on the anterior vaginal wall (patient in knee-breast posture). One can see that while the posture of the patient changed the position of the uterus (which was freely movable) in the pelvis, that the position of the uterus did not affect the trigonum of the bladder or ureters and that the relation between the cervix and these structures was dependent on the position of the uterus in the pelvis.

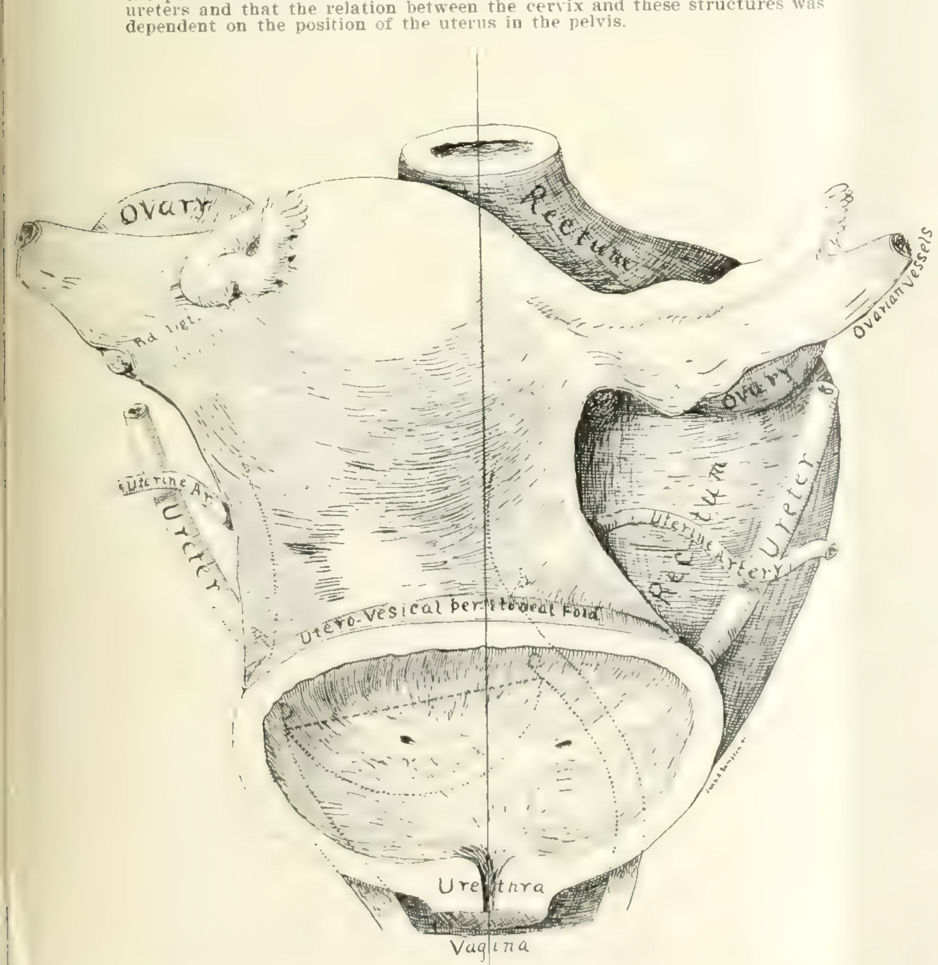
Ovary
Rd lig.
Rectum
Ovarian Vessels
Ovary
Uterine A.
Ureter
Rectum
Uterine Artery
Ureter
Utero-Vesical peritoneal Fold
Urethra
Vagina

FIG. IV. RECONSTRUCTION, SHOWING THE RELATION BETWEEN THE UTERUS AND THE BLADDER FROM CROSS SECTIONS OF THE PELVIS OF A MULTIPARA 30 YEARS OLD. × 1. FROM SPECIMEN IN ANATOMICAL LABORATORY, JOHNS HOPKINS MEDICAL SCHOOL.

The uterus was adherent in retroposition in the right side of the pelvis.

A, B, C, D represents the relatively small area of the bladder attachment when the uterus is in retroposition. The line CD represents the junction of the cervix and vagina.

The right ureteral orifice is directly in front of the cervix, while the left orifice is lateral to the cervix, emphasizing that the relation between the uterus and the ureters and trigonum of the bladder is dependent on the position of the uterus in the pelvis.

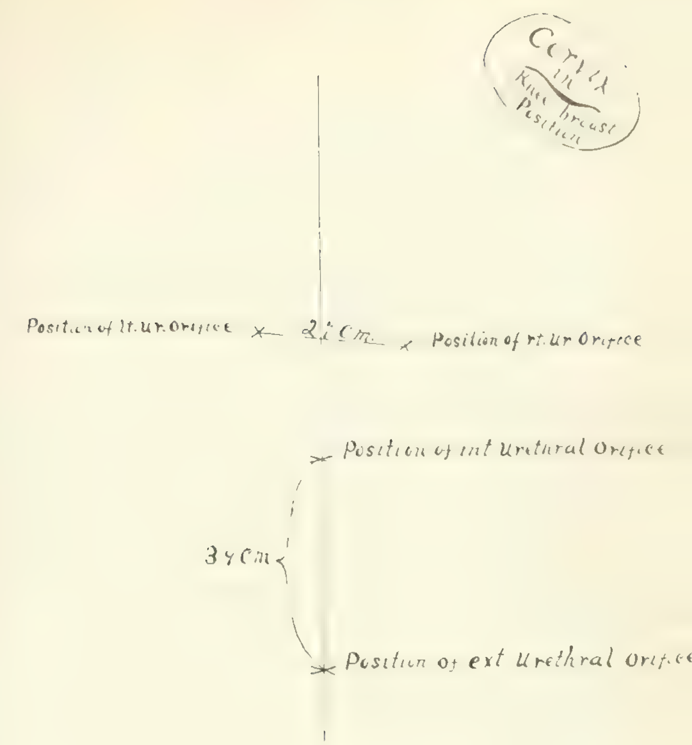
Cervix in Knee breast Position
Position of lt. ur. orifice
2.4 Cm
Position of rt. Ur Orifice
Position of int urethral orifice
3.4 Cm
Position of ext urethral orifice

FIG. II. RELATION BETWEEN THE CERVIX AND THE TRIGONUM OF TH
BLADDER IN UPWARD DISPLACEMENTS OF THE UTERUS. × 7/10.

Para 1, age 44. Uterus drawn upwards by a very large ovarian cy
which was adherent to the uterus; cervix could just be palpated and w
situated far to the right of the median line when the patient was in t
dorsal position. A cystoscopic examination was made, in knee-brea
posture, and the length of the urethra and dimensions of the trigonu
were determined. This illustration is a diagrammatic representation
the findings in the case, as marked out on the anterior vaginal wa
(patient in knee-breast posture). One may see that the extreme displac
ment of the uterus has only slightly affected the trigonum of the bladd
and that the relation between the two is dependent on the position
the uterus in the pelvis.

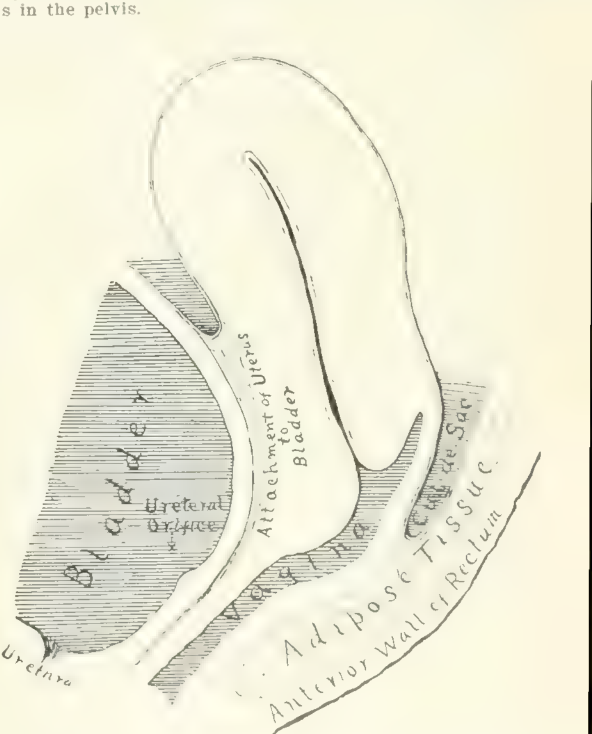
Bladder
Ureteral Orifice
Attachment of Uterus to Bladder
Vagina
Cul de Sac
Adipose Tissue
Anterior Wall of Rectum
Urethra

FIG. III.—SAGITTAL SECTION SHOWING THE RELATION BETWEEN TH
UTERUS AND BLADDER. SLIGHTLY REDUCED.

From autopsy specimen. Pelvic contents removed in one mass and t
hardened in formalin. The uterus is in anteposition and so rests aga
the bladder for a considerable distance.

The bladder is purposely represented as being pulled away from
cervix in order to bring out the relatively loose attachment between
two organs, indicating that under normal conditions they may be ea
separated.

One can see that the growth does not have to extend far in orde
reach the bladder and also that when the entire uterus and a portion of
vagina are removed the bladder wall has been exposed over a large a

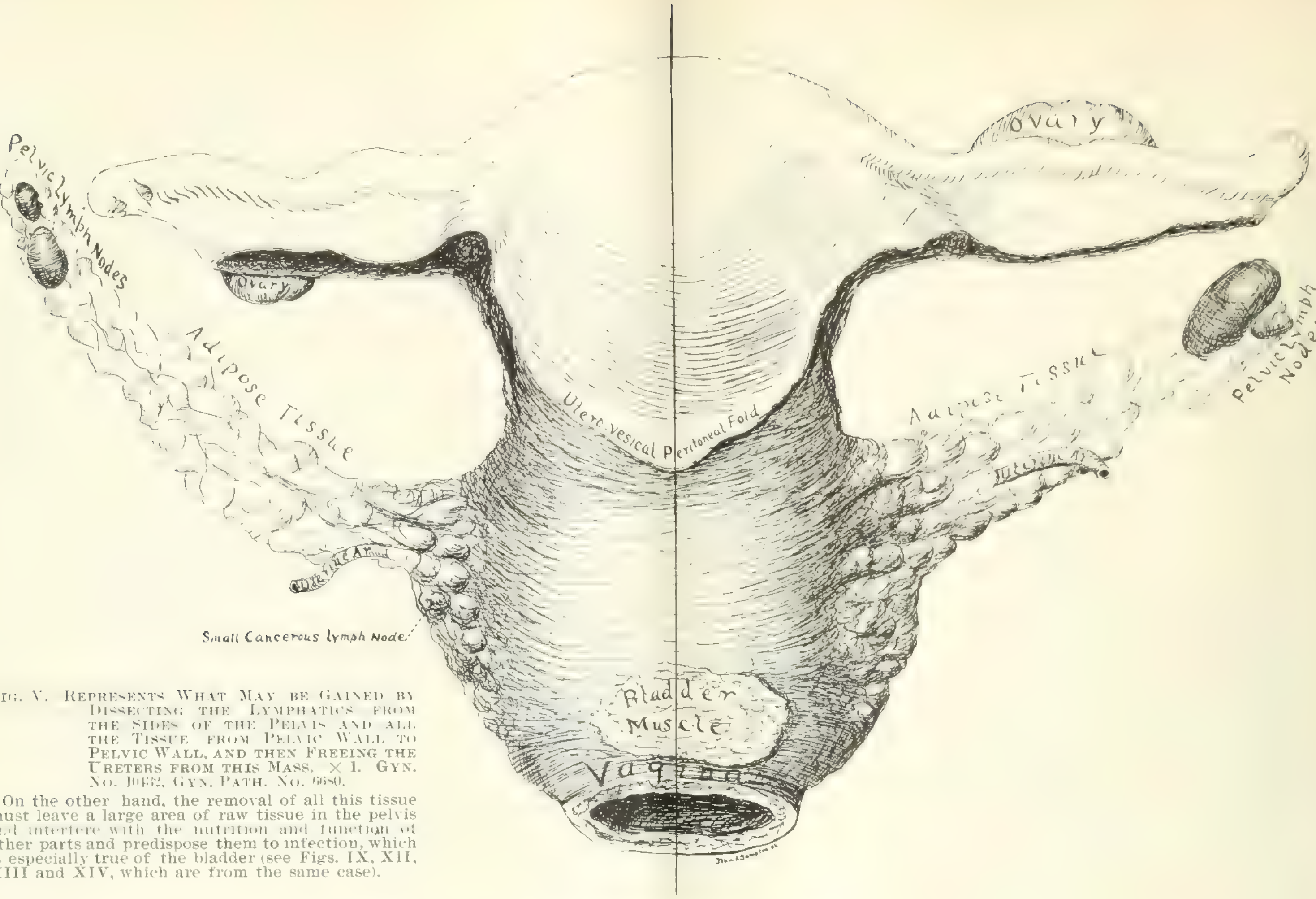
Pelvic Lymph Nodes
Ovary
Ovary
Adipose Tissue
Utero-vesical Peritoneal Fold
Adipose Tissue
Pelvic Lymph Nodes
Uterine Ar.
Uterine Ar.
Small Cancerous lymph Node
Bladder Muscle
Vagina

FIG. V. REPRESENTS WHAT MAY BE GAINED BY DISSECTING THE LYMPHATICS FROM THE SIDES OF THE PELVIS AND ALL THE TISSUE FROM PELVIC WALL TO PELVIC WALL, AND THEN FREEING THE URETERS FROM THIS MASS. × 1. GYN. NO. 10432, GYN. PATH. NO. 6680.

On the other hand, the removal of all this tissue must leave a large area of raw tissue in the pelvis and interfere with the nutrition and function of other parts and predispose them to infection, which is especially true of the bladder (see Figs. IX, XII, XIII and XIV, which are from the same case).

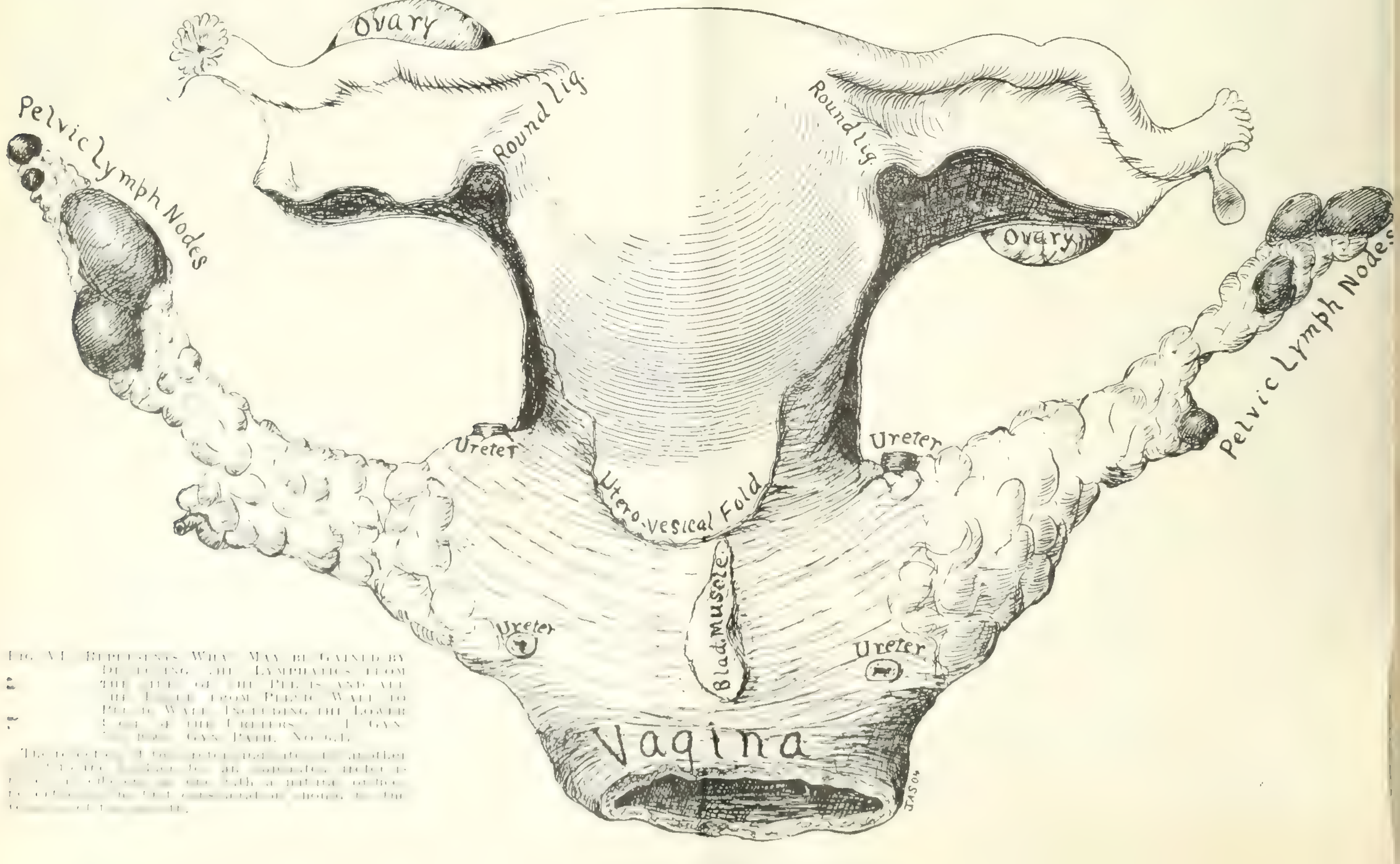
Ovary
Round lig.
Round lig.
Pelvic Lymph Nodes
Ovary
Pelvic Lymph Nodes
Pelvic Lymph Nodes
Ureter
Ureter
Utero-vesical Fold
Ureter
Blad. Muscle
Ureter
Vagina
JAS 04

FIG. VI. REPRESENTS WHAT MAY BE GAINED BY DISSECTING THE LYMPHATICS FROM THE SIDES OF THE PELVIS AND ALL THE TISSUE FROM PELVIC WALL TO PELVIC WALL INCLUDING THE LOWER [illegible] OF THE URETERS. × 1. GYN. [illegible] GYN. PATH. NO. [illegible].

The [illegible] another [illegible]

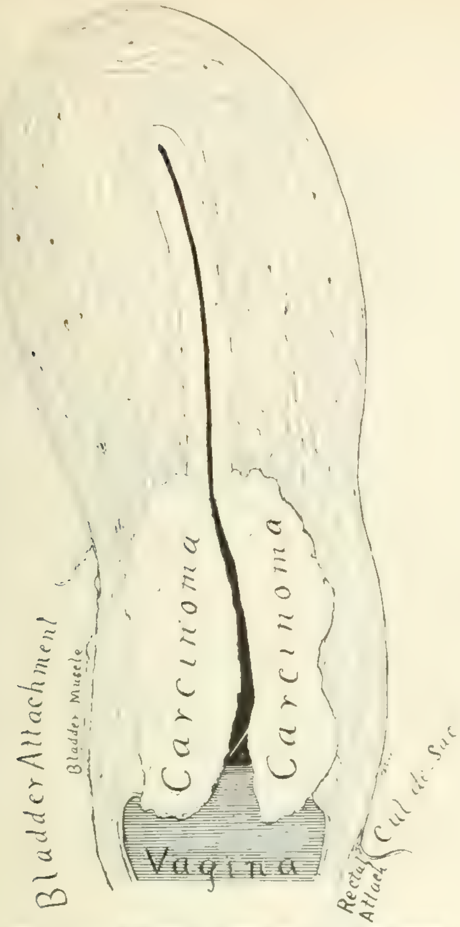
Bladder Attachment
Bladder Muscle
Carcinoma
Carcinoma
Vagina
Rectal Attach
Cul de Sac

FIG. VII.—SAGITTAL SECTION OF CANCEROUS UTERUS, SHOWING THE RELATION OF THE GROWTH TO THE BLADDER. SLIGHTLY REDUCED. GYN. No. 10805. GYN. PATH. No. 6767. FROM THE SAME SPECIMEN AS THE ONE REPRESENTED IN FIG. VI.

The growth in this specimen has not extended through the cervical walls and has invaded the anterior and posterior walls about equally. Notice the bladder attachment, representing the amount of bladder exposed and injured in these operations.

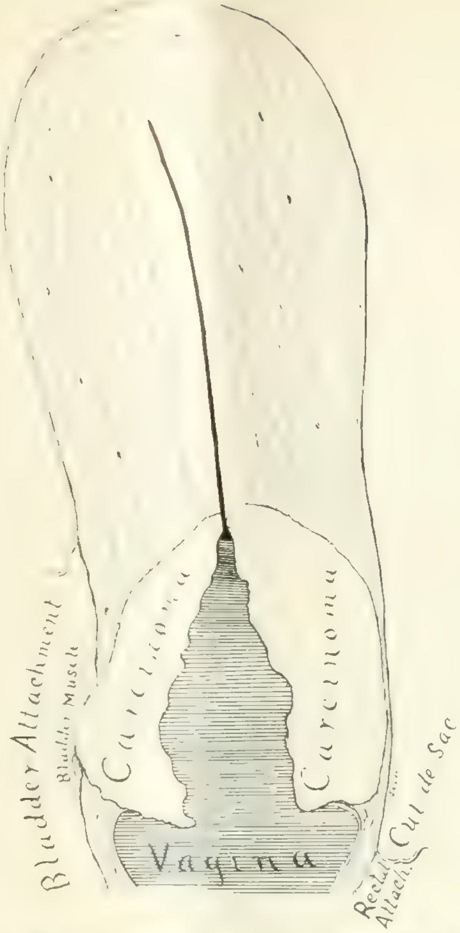
Bladder Attachment
Bladder Muscle
Carcinoma
Carcinoma
Vagina
Rectal Attach.
Cul de Sac

FIG. VIII. SAGITTAL SECTION OF CANCEROUS UTERUS, SHOWING THE RELATION OF THE GROWTH TO THE BLADDER. SLIGHTLY REDUCED. GYN. No. 9903. GYN. PATH. No. 6103.

In this instance the growth, while involving both the anterior and posterior walls of the cervix, has extended beyond the anterior wall and is invading the bladder muscle (see Fig. XI). The cul-de-sac acts as a natural protection against the extension of the growth posteriorly.

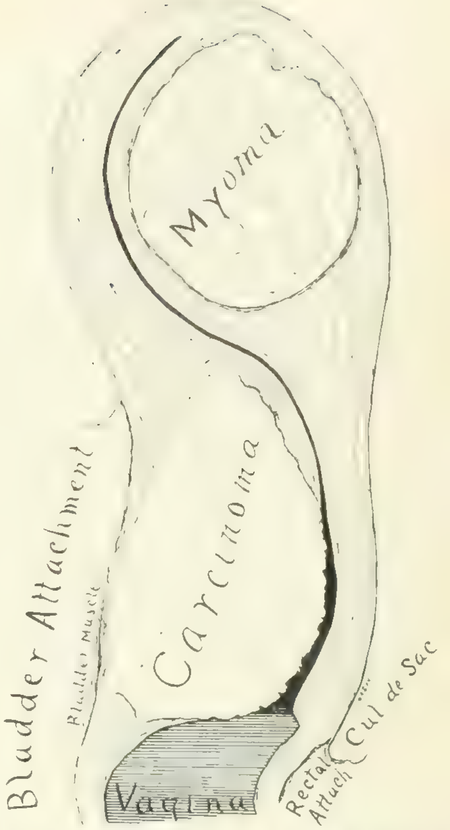
Myoma
Bladder Attachment
Bladder Muscle
Carcinoma
Vagina
Rectal Attach
Cul de Sac

FIG. IX. SAGITTAL SECTION OF CANCEROUS UTERUS, SHOWING THE RELATION OF THE GROWTH TO THE BLADDER. SLIGHTLY REDUCED. SAME CASE AS ONE REPRESENTED IN FIG. V.

The growth is restricted to the anterior cervical wall, and is beginning to invade the bladder anteriorly. The posterior wall of the cervix has been compressed but not invaded by the growth. A small myoma is situated in the fundus. For the injury done to the bladder by this operation, see Figs. XII, XIII and XIV.

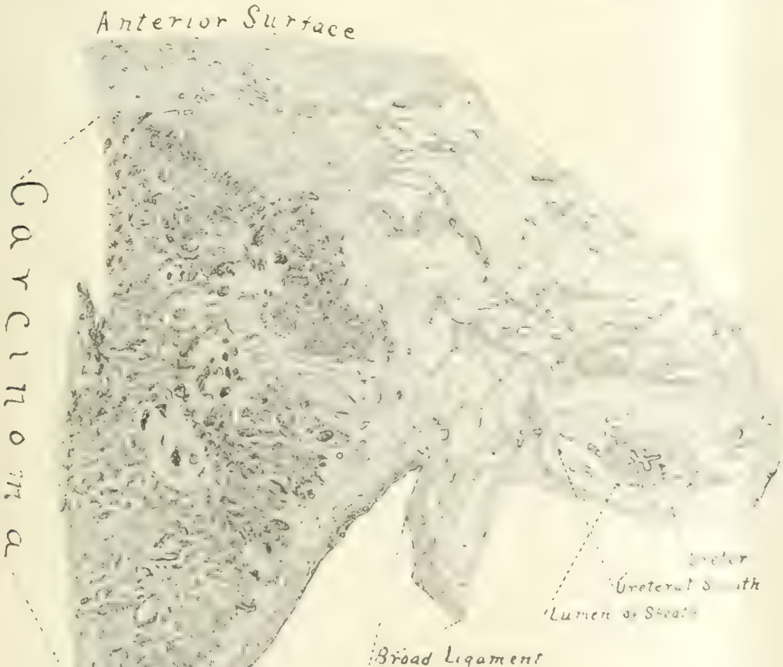
Anterior Surface
Carcinoma
Ureter
Ureteral Sheath
Lumen of Sheath
Broad Ligament
Cervix
John A Sampson 03

FIG. X.—SHOWS THE RELATION BETWEEN CARCINOMA CERVICIS UTERI AND THE BLADDER. UPPER PORTION OF THE CERVIX × 2.

Transverse section of the right parametrium and one half of the [illegible] from a specimen where both ureters were resected. Same case as represented in Fig. VIII. Although the bladder is involved at a [illegible] level, here it is free. (See Fig. XI.)

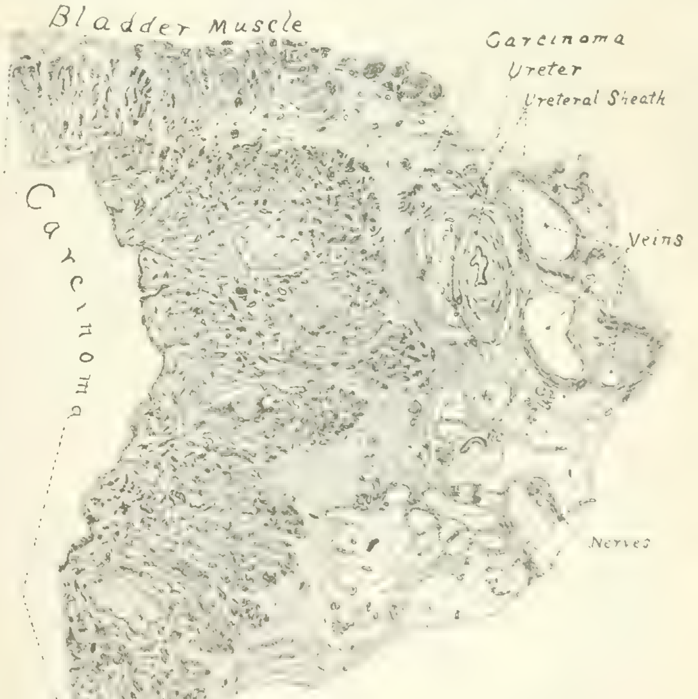
Bladder Muscle
Carcinoma
Ureter
Ureteral Sheath
Veins
Carcinoma
Nerves
John A Sampson 03

FIG. XI. SHOWS THE RELATION BETWEEN CARCINOMA CERVICIS UTERI AND THE BLADDER. LOWER THIRD OF THE CERVIX × 2.

From the same specimen from which Fig. X was drawn, only in the lower third of the parametrium.

At this level the growth has invaded the bladder and laterally has extended out to the ureters which unfortunately are nearer the cervix at this level than higher up in the parametrium, as in Fig. X. Notice the protection afforded to the ureters by the ureteral sheath.

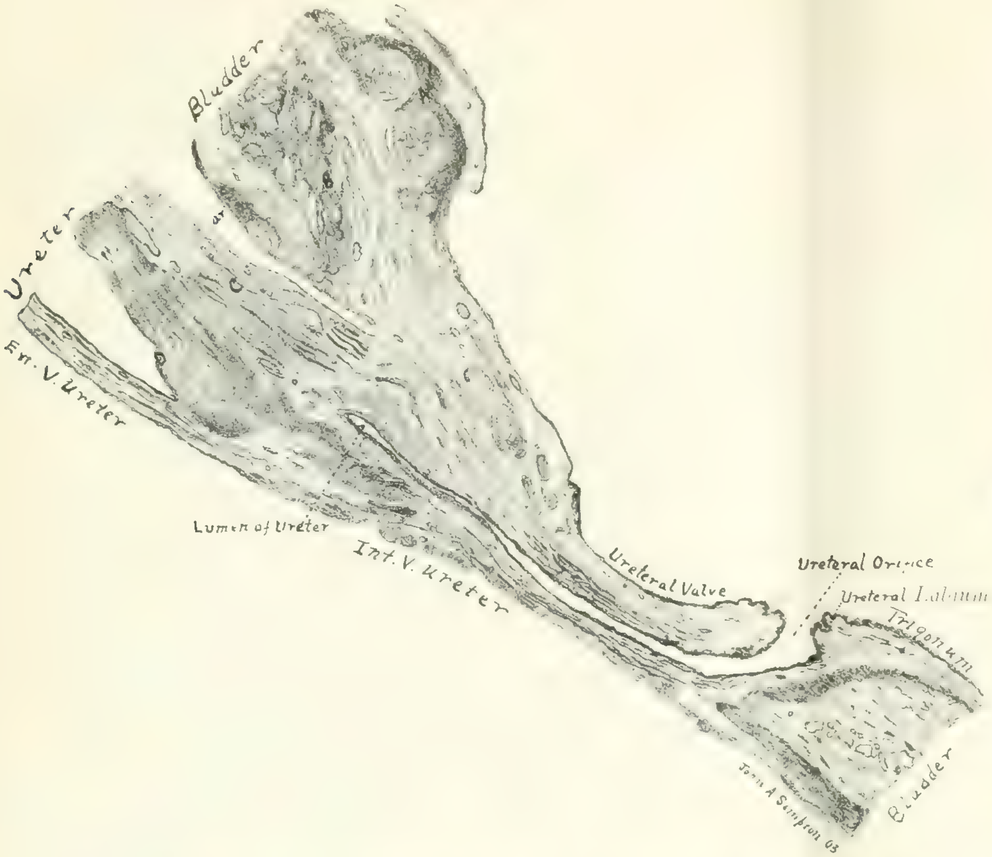
Bladder
Ureter
Ex. V. Ureter
Lumen of Ureter
Int. V. ureter
Ureteral Valve
Ureteral Orifice
Ureteral Labium
Trigonum
Bladder
John A. Sampson 03

FIG. XII. LONGITUDINAL SECTION THROUGH RIGHT URETERAL ORIFICE, FROM A PATIENT DYING OF UNILATERAL (RIGHT) ASCENDING RENAL INFECTION. × 4. SAME CASE AS ONE REPRESENTED IN FIGS. V AND IX.

Notice how thin the bladder wall is posterior to the lumen of the ureter. The infection has apparently extended through the bladder wall, A, B, C, D, thus involving the ureter. The vesical portion of the ureter became involved and was converted into a sinus so that pressure over the bladder forced the bladder contents through the ureter into the pelvis of the kidney.

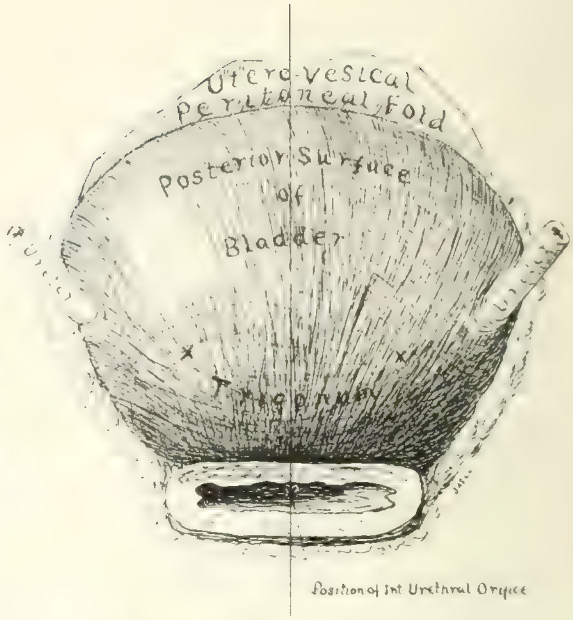
Utero-vesical peritoneal Fold
Posterior Surface of Bladder
Ureter
Ureter
Trigonum
x
x
Position of Int Urethral Orifice

FIG. XIII. POSTERIOR SURFACE OF THE BLADDER, SHOWING THE AMOUNT OF BLADDER EXPOSED AND INJURED IN THESE OPERATIONS. SLIGHTLY REDUCED.

Same case as represented in Figs. V and IX. The entire posterior surface of the bladder has been exposed and injured beginning above at the utero-vesical peritoneal fold and extending below almost to the internal urethral orifice and laterally beyond the entrance of the ureters into the bladder. It is little wonder that the bladder is so injured that it is unable to resist infection. (See Figs. XII and XIV, from the same case.)

The probable position of the ureteral orifices are represented by *x*, *x*. The vagina is represented cut transversely.

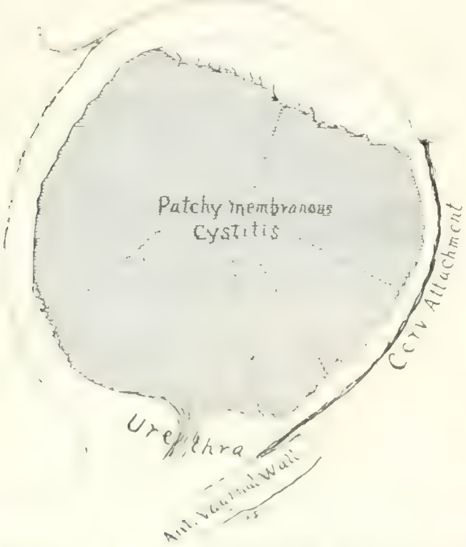
Patchy membranous Cystitis
Cerv Attachment
Urethra
Ant. Vaginal Wall

FIG. XIV. SAGITTAL SECTION OF BLADDER FROM PATIENT DYING OF ASCENDING RENAL INFECTION FOLLOWING ONE OF THESE OPERATIONS. SLIGHTLY REDUCED. SAME CASE AS REPRESENTED IN FIGS. V, IX, XII, XIII.

The bladder area exposed by the removal of the uterus and portion of the vagina is shown. A patchy membranous cyst was found at autopsy and the area corresponded to the portions of the bladder which would [illegible] the retention catheter which was placed in the bladder in order to keep it empty. I think that the mushroom catheter acted as a foreign body and aggravated the bladder infection and may have been responsible for the renal infection and death of the patient.

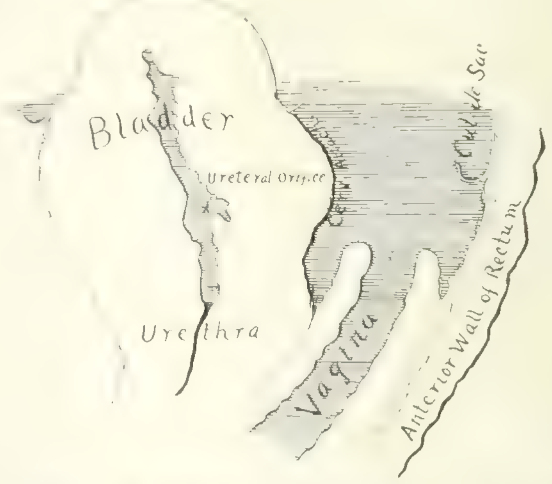
Bladder
Ureteral Orifice
x
Cervix
Cul de Sac
Urethra
Vagina
Anterior Wall of Rectum

FIG. XV. SAGITTAL SECTION OF BLADDER FROM PATIENT DYING SIX DAYS AFTER ONE OF THESE OPERATIONS. CAUSE OF DEATH NOT DETERMINED AT AUTOPSY. GYN. NO. 10084. GYN. PATH. NO. 6284.

The bladder was found to be contracted but free from cystitis. As one can see in the contracted bladder, the walls are thicker and there is less of the raw area exposed than in the distended bladder, as in Fig. XIV. Its nutrition should also be better. It would seem best to keep the bladder empty after these operations. A retention catheter is dangerous, acting as a foreign body, and it is also likely to become occluded or pushed too far in the bladder. Frequent catheterizations are better, and if cystitis develops, make a vesico-vaginal fistula.

genes aureus was injected into the bladder. These dogs were killed in from 2 to 10 days. In every instance the organism was regained from the bladder but not from the kidneys. In two instances there was some evidence of slough of the bladder and in four of the five cases, marked evidence of cystitis. We have then in the interference of the blood supply of the bladder a means of lowered local resistance, which must be considered an important etiological factor in the causation of experimental cystitis. Another important accessory etiological factor in the causation of experimental cystitis is retention of urine, which may be accomplished by ligating the urethra or penis of the animal. This has been shown by many who have experimented along these lines.

CLINICAL CASES DEMONSTRATING INJURY TO THE BLADDER AS A RESULT OF HYSTERECTOMY FOR CARCINOMA CERVICIS UTERI.

The 19 instances of accidental injury to the bladder in 157 hysterectomies for carcinoma cervicis uteri emphasize the close anatomical relation between the two organs and that the extension of the disease soon involves the bladder, so that the separation of the bladder from the growth results in injury to the bladder which may manifest itself as a vesical fistula, recognized either at the time or afterwards.

The frequency of cystitis following these more radical operations is another indication of the close relation between carcinoma cervicis uteri and the bladder and indicates that as a result of the operation the bladder is left in a condition of lowered local resistance and that this condition is responsible for the cystitis which may later develop, as was maintained by Wertheim[10] in the report of his second series of 30 cases. Krönig[11] has carefully described the technique of closing the raw areas caused by these operations and emphasizes the importance of covering the posterior surface of the bladder by bringing down the utero-vesical peritoneal flap and suturing it to the anterior vaginal wall as a means of protecting the injured bladder and thus lessening the chance for cystitis. Taussig[12] has reviewed Wertheim's cases and demonstrated the importance of retention of urine as an etiological factor in the causation of cystitis and that in these more radical operations this is especially likely to occur. He calls attention to the fact that ganglia and nerves are found in the parametria of these cases and that their removal may interfere with the function of the bladder and so give rise to the retention of urine. Kolischer,[13] in addition to the other views already mentioned, as, injury to the bladder, blood supply, etc., adds another, *i. e.,* in freeing the ureters certain trophoneurotic disturbances occur which predispose the bladder to cystitis. Bäisch[14] considers that the main factors in the causation of the cystitis following these operations results from injury to the nerves and blood supply of the bladder. He advocates catheterization followed by bladder irrigation as prophylactic measures in the avoidance of this cystitis.

In order to make a positive diagnosis of cystitis two things must be done: first, a cystoscopic examination must be made and the inflamed bladder seen; secondly, cultures must be taken and the organism causing the infection obtained. These two steps are essential, for an inflamed-appearing bladder may not be infected, and positive cultures obtained from the urine may come from an infected kidney and the bladder may be normal or the organisms may be excreted by the kidneys and appear in the urine without causing any harm to either kidney or bladder.

I have followed the bladder condition in sixteen cases where hysterectomy for carcinoma cervicis uteri has been done. In 14 of these cases both cystoscopic examinations and urine cultures were taken and in the other 2 cases the patients died, one on the ninth day and the other on the seventeenth day, and at autopsy the cause of death was found to be ascending renal infection. The ureters had been sacrificed in one but not in the other of these two cases. In 10 of the 14 cases who lived, cystitis was found to be present, as determined by cystoscopic examination and taking cultures, and in 3 of the 4 cases in which the bladder apparently escaped infection, an accidental vesico-vaginal fistula was present, which apparently prevented a cystitis, for cultures taken in two of these cases showed colon bacillus in large numbers. In 12 of the 16 cases cystitis occurred, resulting in renal infection and death in 2 cases. In all the cases but one the raw areas were covered with peritoneum, and in that one case it was necessary to leave on clamps and pack with gauze in order to control hemorrhage. In these cases the utero-vesical peritoneal fold was sutured to the anterior vaginal wall and the entire denuded vesical wall was protected by peritoneum. In addition, the posterior vaginal wall was sutured to the recto-uterine peritoneal fold, thus covering in the raw tissue anterior to the rectum. The pelvis was drained by two small gauze drains extending under the peritoneum on each side and out through the vaginal opening. Yet these cases did not escape cystitis. Realizing that retention of urine was an important etiological factor in the causation of cystitis I used a retention mushroom catheter in four cases; in all four cases cystitis developed, resulting in ascending renal infection and death in two, and in one of these there was a patchy, membranous cystitis, the patches corresponding to the parts of the bladder which came in contact with the catheter when the bladder collapsed (see Fig. XIV). Apparently the catheter was responsible for the severity of the cystitis, for it may soon become covered with urinary salts acting as a foreign body (stone) in the bladder. Another criticism against the retention catheter is that it is apt to become occluded or pushed too far in the bladder, and one can never tell whether or not it is doing what it is supposed to do, that is, keeping the bladder empty by draining the urine away as fast as it comes to the bladder.

Frequent catheterization was tried, *i. e.,* every three to four hours, in the next nine cases, but cystitis developed in eight of the nine cases. In two of these cases the bladder was irrigated three times a day, and in four cases every three or four hours after catheterization.

Why does cystitis occur in these cases? I have been unable to prevent it by covering the injured bladder with peritoneum and also by preventing retention of urine by means of the retention catheter or frequent catheterization, and in six cases in which bladder irrigations were tried as a prophylactic measure the cystitis was not avoided. I cannot see how that dissecting free the ureters, aside from the fact that more of the bladder is exposed and surrounding tissue injured, can be considered an important etiological factor, for I followed the condition of the bladder in three cases in which an abdominal hysterectomy was done for cancer of the body of the uterus, the entire uterus with a vaginal cuff having been removed. Cystitis occurred in two of the three cases and yet the ureters were not seen during the operation. On the other hand, abdominal supravaginal hysterectomies for myomata, pelvic inflammatory conditions, etc., are very rarely followed by cystitis. The difference between these operations and the more radical operations for carcinoma cervicis uteri must be considered the main accessory etiological factors in the causation of the cystitis, and are as follows:

1. The large area of the bladder exposed and injured in removing the cervix with parametrium and also portion of the vagina. (Figs. XIII and XIV).

2. Interference with the blood supply of the bladder, caused by ligating vessels giving rise to vesical arteries; freeing the bladder, thus cutting off vessels going to it; and the injury of vessels in the bladder wall.

3. Interference with the function of the bladder, it having been injured in freeing it, its blood supply having been interfered with, some of its natural supports removed, and its nerves and ganglia destroyed. This interference with its function may manifest itself in the inability to void urine. On the other hand, in one patient incontinence was present, there being no ureteral or vesical fistula. In other cases the patient may void urine, but there may be a large residual of urine left in the bladder. In one of the above cases this was as great as 300 cc.

Organisms may gain access to the bladder in various ways:

1. They may be present in the bladder at the time of the operation. They were present in one of the above cases, although there was no evidence of cystitis at the time.

2. They may pass through the injured bladder wall through the fundus or trigonum, or along the bared ureters if dissected free or resected and implanted in the bladder.

3. In the process of catheterizing the bladder, organisms may be carried in.

4. Organisms may be carried down from the kidneys or conveyed to the bladder by the circulating blood.

It becomes evident that the relation between carcinoma cervicis uteri and the bladder is a very important one on account of the early invasion of the bladder and also because of the likelihood of post-operative cystitis with its accompanying danger of ascending infection.

The next question which must be considered is the bearing of the above on these more radical operations.

The Bearing of the Relation between Carcinoma Cervicis Uteri and the Bladder on the More Radical Operations for that Disease.

A study of specimens from these more radical operations emphasizes the importance of a wide excision of the primary growth, and that the bladder anteriorly and the ureters laterally may soon be involved in the extension of the disease. A study of the bladders obtained at autopsy from those cases who have died after these more radical operations, as well as the clinical histories of those who survive, shows how frequently cystitis follows these operations and that the danger of ascending renal infection is a very important consideration.

A very instructive feature associated with these cases is that an accidental vesico-vaginal fistula was present in three of four cases in which cystitis apparently did not develop. The presence of a vesico-vaginal fistula meant that intravesical tension was absent and that the injured bladder was put at rest and cystitis did not develop, or was much less severe. We realize that the formation of a vesico-vaginal fistula is the best means we have of treating severe cystitis. The best surgical treatment for infection in any part of the body is free incision and drainage, together with rest of the part diseased, and that is what a vesico-vaginal fistula does for an infected bladder. Its significance here is most important. On account of the proximity of the bladder to the uterus the growth does not have to extend far anteriorly to involve the bladder.

The avoidance of injury to the bladder means in many instances a return of the growth and cystitis, with the danger of ascending renal infection. The wide excision of the growth with any portion of the bladder adherent, means a higher percentage of cures and the probable avoidance of cystitis and ascending renal infection.

In cases in which the bladder is not involved by the growth it is not necessary to sacrifice a portion of the bladder. In these cases all raw areas should be covered with peritoneum. The utero-vesical peritoneal fold should be sutured to the anterior vaginal wall and the recto-uterine to the posterior vaginal wall. There is no advantage to be gained in the removal of a long portion of the vagina, unless it is involved by the growth, and there is this disadvantage: that the more vagina removed, the greater the injury to the bladder. A wide excision of the tissue surrounding the upper portion of the vagina is more important. Afterwards the patient should be catheterized every three to four hours, and the bladder irrigated after each catheterization, and at the first suggestion of cystitis, as seen by pus in the urine, the bladder should be examined and if there is evidence of a marked cystitis a vesico-vaginal fistula should be formed.

A satisfactory cystoscopic examination may be made with the patient in the Sims' posture,[8] and if evidence of cystitis is seen, the opening into the bladder may be made as follows: The handle of the cystoscope is pushed towards the symphysis so that the end of the cystoscope causes the anterior vaginal wall to bulge at a point just posterior to the internal urethral orifice. This bulging point is opened with a knife and the incision enlarged posteriorly with scissors. This may be done without even a local anesthetic, for these extensive operations apparently destroy the sense of pain over this portion of the vagina and bladder. I have done this in one instance with apparently most satisfactory results.

Under normal conditions the sensibility of the vagina to pain and touch varies in different individuals. In some cases the entire vagina down to the vulvar orifice seems almost insensitive to pain, so much so that such operations as anterior and posterior colporrhaphies may be done without even a local anesthetic and without causing any severe pain to the individual. On the other hand, in other individuals the vagina is quite sensitive to pain. The vulva is always very sensitive and one must be very careful not to pinch or cut it in these operations. I have done several minor vaginal operations without the use even of a local anesthetic, and find that where indicated, and in suitable cases these operations may be done with but very little discomfort to the patient. I refer to such operations as anterior and posterior colporrhaphies and the making and closure of vesico-vaginal fistulæ. I do not know why there is this great difference in cases. It is not always due to child-birth, for I have found instances among nullipara where the vagina was relatively insensitive. Up to this date I have tested the sensibility of the vagina in over seventy-five cases, by exposing it and pinching it with forceps or pricking it with a right-angle tenaculum. While in many cases the vagina is so insensitive to pain that pieces of vaginal mucosa may be excised and the raw areas closed with sutures, as in anterior and posterior colporrhaphies, and the pain and discomfort are so slight that the patient will not cry out and frequently not even wince; nevertheless, in some cases such operations would give rise to great pain and torture. The interesting feature of this relative insensibility of the vagina is that it is apparently rendered still less sensitive by these more radical operations, so that vesico-vaginal fistulæ may be made and closed without the use of an anesthetic and without causing the patient any severe pain. In only one instance have I intentionally made a vesico-vaginal fistula for cystitis following these operations and the parts were so insensitive that the patient did not know when it was done. The restoration of what little sensibility there is in the vagina must be very slow, for I closed a vesico-vaginal fistula following one of these more radical operations six months after the operation, yet the closure of the fistula did not cause the patient a particle of pain.

CONCLUSIONS.

I. The cervix rests against the bladder posterior to the trigonum and under normal conditions the two organs are but loosely attached to each other so that their separation is easily accomplished. The size of the vesical area varies in different cases, and also with the position of the uterus in the pelvis and degree of distension of the bladder.

II. The growth in its anterior extension soon reaches the bladder, as manifested by the vesico-vaginal fistulæ resulting from the necrosis of the growth which has involved the bladder and accidental openings made in the bladder in freeing that organ from the cervix during hysterectomy for carcinoma cervicis uteri.

III. Freeing the uterus, parametrium, and upper portion of the vagina from the bladder exposes a large area of the bladder wall, extending from above at the utero-vesical peritoneal fold to a point below, which varies with the amount of the vagina removed, but usually exposing a portion of or the entire trigonum. This area laterally extends beyond the entrance of the ureters into the bladder, if the ureters are resected or dissected free. There is no advantage to be gained in the removal of a long portion of the vagina unless it is involved by the growth, and the more vagina removed, the greater the injury to the bladder. On the other hand the wide excision of the tissue surrounding the upper portion of the vagina is most important.

IV. In freeing the bladder it is injured, the amount of injury varying with the difficulty experienced in freeing it, which in turn is dependent upon whether the bladder is adherent or not.

V. The blood supply of the bladder may be impaired by the ligation of large vessels from which vesical arteries may arise, and also in freeing this large bladder area all vessels going to this area are destroyed and in addition vessels in the bladder wall may be injured.

VI. Nerves and ganglia are removed or destroyed in these operations, which may be important structures in maintaining the physiological activity of the bladder.

VII. The function of the bladder is impaired by these injuries, as shown by the retention of urine or an inability to empty the bladder completely, which is apt to follow these operations.

VIII. Injuries resulting from the operation, together with the impairment of function following them, lessens the resistance of the organ, so that it is usually unable to resist infectious organisms which may gain access to the bladder, and cystitis results. In addition to the avenues available for the entrance of organisms into the bladder a new one now presents itself, viz.: that is, the injured bladder wall.

IX. Cystitis occurred in 12 of 16 of these cases where I have followed the bladder conditions after operation, and in two of the twelve cases it resulted in renal infection and death. In three of the four cases in which cystitis apparently did not occur an accidental vesico-vaginal fistula was present, which apparently prevented a cystitis, for cultures taken in two of these cases showed colon bacilli in large numbers.

X. The best surgical treatment for infection in any part of the body is incision and *free* drainage, together with rest of the part diseased; and apparently this is what a vesico-vaginal fistula does for these cases.

XI. It seems best that following these operations the bladder should be catheterized every three or four hours, followed by a bladder irrigation as a prophylactic means of preventing retention of urine and avoiding or lessening the severity of the cystitis, and should a severe cystitis develop as determined by cystoscopic examinations, a vesico-vaginal fistula should be made, which may be done without even a local anesthetic, and if it does not close spontaneously it may also be closed without an anesthetic, as has been described in this article.

XII. *The excision of portions of the bladder adherent to the growth improves the chances of a cure and the presence of a vesico-vaginal fistula apparently lessens the chances of a post-operative cystitis and the danger of an ascending renal infection.*

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CAESAREAN SECTION AND SERIOUS DYSTOCIA FOLLOWING VENTRO-FIXATION AND SUSPENSION.[1]

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Since the introduction of the various operative procedures by means of which it has been attempted to correct posterior displacements of the uterus by stitching it to, or suspending it from the anterior abdominal wall, reports have from time to time, appeared in the literature of abnormalities during pregnancy and dystocia at the time of labor following such operations.

Fortunately, in the vast majority of cases, the course of pregnancy and labor has been favorable, although in a small, but apparently increasing number of cases, serious disturbances have been noted. As might be expected, the degree of dystocia has varied according to the character of the operation performed. Thus, serious dystocia has so frequently followed vaginal fixation of the uterus that it has become generally agreed that the operation is not justifiable during the child-bearing period. On the other hand, there is as yet no unanimity of opinion as to the effect of ventro-fixation upon pregnancy and labor. Most authors believe that it is in general a harmless procedure and attribute the untoward results, which sometimes follow it, to errors in technique; but nevertheless, the impression has gradually gained ground that serious dystocia may occur in a certain proportion of cases, so that many gynecological surgeons have abandoned the operation and recommend that the uterus should be suspended from the anterior abdominal wall by means of newly formed ligaments, which consist merely of a fold of peritoneum. The advocates of ventro-suspension, as it is called, claim that these become stretched as pregnancy advances, and thereby allow the enlarging uterus to ascend freely into the abdominal cavity. Recent observations, however, tend to show that even this operation is not devoid of danger from an obstetrical point of view, as in exceptional cases it appears impossible to limit the adhesions to the desired extent, and consequently fixation of the uterus may result, where only suspension was desired. For this reason, many surgeons of experience have recently abandoned it in favor of operations in which the uterus is maintained in the desired position by shortening the round ligaments in one way or the other after opening the abdomen.

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[1] First published in German in Der Monatsschrift für Geburtshülfe und Gynaekologie, April, 1904, and read by invitation at the Chicago Gynaecological Society, December 19, 1903.

It is my object in this paper to call attention to some of the serious complications which are sometimes encountered during pregnancy or labor following ventro-fixation, and occasionally even after suspension of the uterus; and particularly, to report in detail two cases of serious dystocia resulting from this cause; and finally, after studying the cases reported in the literature, to inquire whether either of the operations is justifiable from an obstetrical point of view.

CASE 1.—K. R., a colored woman, 25 years old, was admitted to the Johns Hopkins Hospital on Jan. 21, 1902, with the following history: She was always well and strong as a child, but several years ago had an attack of inflammatory rheumatism, which confined her to bed for three weeks, and left her with a shortness of breath after slight exertion. She has had three normal labors and no miscarriages. Menstruation began at the fourteenth year, occurring every four weeks and lasting eight days with considerable pain.

Eighteen months after the birth of her last child she began to menstruate at intervals of two weeks, and complained of headache, and pain in the back and lower abdomen in the intervals between the menstrual periods. Sixteen months prior to admission to the hospital, her left ovary was removed at another hospital in Baltimore, but as the operation gave no relief, her uterus was stitched to the anterior abdominal wall one month later. At the same time she was told that it would be impossible for her to become pregnant again. She, however, menstruated two or three times afterwards, and believed that her last period occurred eleven months before her admission to the Johns Hopkins Hospital. She had no idea that she was pregnant, though in August she noticed that her abdomen was growing larger. At no time did she experience any of the subjective symptoms of pregnancy, nor did she perceive fœtal movements. Three weeks before her admission to the hospital she was obliged to give up her work on account of cough, pain in the region of the abdominal scar and swelling of the feet and legs. While on her way to the hospital she slipped and fell from a street car, since when she has had sharp, intermittent abdominal pains resembling labor pains.

Examination on Admission.—A fairly well-developed negress, with pendulous breasts containing colustrum. Auscultation shows that the lungs are normal, but a rough systolic murmur, which is transmitted into the axilla, is heard at the apex of the heart. The abdomen is occupied by a soft tumor which extends 25 cm. above the symphysis and approaches to within 12 cm. of the zyphoid cartilage, the umbilicus being 16 cm. above the symphysis. It contracts at intervals of fifteen minutes and is identified as an 8 months pregnant uterus, with the fœtus lying obliquely with its head in the left upper quadrant. Just above the symphysis pubis there is a somewhat retracted scar 9 cm. long and 2 cm. wide, to which the uterus seems fixed by a firm band of adhesions, which extends upwards and appears to draw the fundus of the uterus downwards and forwards. The round ligaments cannot be palpated definitely.

On vaginal examination the cervix is found high up in the pelvis and displaced posteriorly, its canal is intact and the external os sufficiently patulus to admit one finger. The pelvis is generally contracted and presents the following measurements: 23, 27, 28.5, 19.75 and 10.75 cm.; the conjugata vera being estimated at 9 cm.

During the greater part of the eleven weeks which the patient spent in the hospital prior to delivery, she was confined to bed by almost constant pain in the region of the abdominal scar. This was so severe that the daily administration of sedatives and hypnotics was necessary. As pregnancy advanced the child came to lie in a transverse position, and the abdominal scar gradually became more and more retracted, its upper extremity apparently marking the lower limit of abdominal respiration. The uterus was so extremely irritable that the patient was several times thought to be in labor, and on one occasion definite painful contractions occurred at intervals of forty-eight hours and then passed away.

The patient fell into labor at 4 A. M., April 9, 1902, the pains gradually becoming more frequent and severe during the course of the day. On vaginal examination the child was found to lie in L. O. I. T. with the head not engaged, while the cervix had become markedly retracted, as compared with its condition during pregnancy, so that the external os was situated several centimeters above the sacral promontory and almost in contact with the spinal column, forming an acute angle with the anterior portion of the lower uterine segment. The cervix dilated very slowly, and after fifteen hours of hard pains its canal was still 3 cm. in length and the internal os only sufficiently dilated to admit two fingers. As the condition of the patient gradually became serious, operative interference was deemed necessary, and it was a question whether Caesarean section would be necessary for delivery.

On account of the softened condition of the cervix, Prof. Williams believed that normal dilatation could be effected and the child delivered by the vagina after version. Accordingly, the cervix was dilated by Harris' method with considerable difficulty, on account of the constrained position which the hand was obliged to assume. The membranes were then ruptured, and after version a living child, 48.5 cm. long, and weighing 3070 gms., was extracted with some difficulty. The biparietal diameter measured 9 cm. During the third stage the placenta could be distinctly felt lying in the anterior portion of the uterus, and was expressed without difficulty by Credés manœuvre.

The puerperium was afebrile, but the patient complained of great pain in the neighborhood of the scar.. This was so severe that she walked in a somewhat doubled-up position, with hesitating steps. One month after delivery, the uterus was found to be in acute ante-position, firmly attached to the abdominal scar by short dense adhesions, and considerably larger than it should be. The cervix, however, had regained its normal position and was somewhat lacerated.

As the pain continued and was so severe as to prevent the patient from working, she returned to the hospital nine weeks after the operation, seeking relief. Accordingly, the abdomen was opened under ether anæsthesia, when a firm mass of adhesions 6 to 7 cm. long, and as broad as one's thumb, was found uniting the anterior aspect of the fundus with the abdominal scar. Imbedded in the adhesions were three silkkworm gut sutures, which passed through the recti muscles. The uterus appeared to be about twice as large as usual, while the appendages were lacking on one side and normal on the other. The cicatrix was dissected from the abdominal wall and anterior surface of the uterus, the raw surfaces of which were approximated with the catgut sutures, and the organ dropped back into the abdominal cavity. The patient made an uneventful recovery, although she still complained of some abdominal pain, which was sufficiently severe to prevent her from attending to her household duties for several months. On discharge from the hospital, and on later examination, the uterus was found in ante-position, normal in size and freely movable.

Case 2.—Mrs. M., white, aged 37. Has always been rather delicate and a mouth-breather since early childhood. She has a typical pigeon breast, which she claims is hereditary. She has had nine children and two miscarriages, the eldest child being 18 and the youngest 5 years old; all labors were normal and there was no puerperal trouble.

During the past few years she has complained of symptoms referable to the pelvic organs, for which her cervix and perineum were repaired in 1901, without, however, affording much relief. Accordingly, a competent operator suspended the uterus from the anterior abdominal wall by means of two silk ligatures on April 1, 1902, after which she made an uninterrupted convalescence. Prior to the latter operation the patient had menstruated almost continuously, but as the subsequent history will show, was pregnant at the time it was performed. Fœtal movements were perceived early in August, 1902, and at the same time she began to complain of sharp pains in the region of the bladder and abdominal scar, which increased so in severity that she took to bed in October and required large doses of morphia in order to procure sleep.

I saw the patient in consultation with Dr. W. F. Taylor, of Laurel, Maryland, Oct. 31, 1902, when she was suffering from severe abdominal pain, some fever, and excessive vomiting. At the time of the consultation the temperature was 100° and pulse 120. The abdomen was greatly distended, so that twins or hydramnios were suspected, but the uterus was so rigid that a fœtus could not be outlined. The cervix could not be detected in making a vaginal examination in the usual manner, and could be felt only after introducing the half hand, when it was found to be short and undilated, with the external os at the level of, and pointing somewhat to, the right of the promontory, and closely approximating it. Three days later I saw the patient again, when the temperature was 102°, pulse 120, and respiration 28 to the minute. These symptoms could apparently be accounted for by a severe pharyngitis and laryngitis; but in view of the probability of serious dystocia at the time of labor she was advised to come to Baltimore and enter the Church Home and Infirmary, which she did on the 3d of November, 1902.

Examination on admission showed a frail, emaciated woman in dorsal decubitis, who complained of shortness of breath while lying down, and of severe pain in the region of the abdominal scar. The limbs were so emaciated that the upper arm could easily be spanned with the fingers of one hand. The finger tips were clubbed and the nails curved and thickened, and there was some œdema about the feet and ankles. The pharynx and tonsils were red and swollen, while the chest presented the deformity already mentioned. On physical examination, expansion was equal on both sides, vocal fremitus was normal, the lungs were hyperresonant on percussion and a few crackling râles could be heard at the left apex. Forcible pulsation was apparent over the entire precordial area, but there was no thrill, the cardiac dulness extending to the right sternal margin in the fourth interspace, and the heart sounds were clear. The temperature was 100°, pulse 106, respirations 28. The entire abdomen was extremely pendulous, and the uterine tumor extended 45 cm. above the symphysis on a curved line, and to within 8 cm. of the zyphoid cartilage, while the umbilicus was 35 cm. above the former. Immediately above the symphysis was a non-retracted vertical scar, 7 cm. long and 2 cm. wide, to which the uterus was firmly adherent. The round ligaments were felt with difficulty, the right extending downward and outward from the upper angle of the scar, and the left downward and inward into the left flank. A fœtal head was felt in the left upper quadrant, but small parts could not be made out. The fœtal heart was heard in the middle line and beat 140 to the minute. The pelvis was normal. On vaginal examination no presenting part could be felt, and the cervix was in the position already described.

From the time of admission until labor set in on Nov. 9, the temperature varied between 99° and 101°, and the pulse from 100 to 120, while the patient complained of sore throat and severe pain in the abdomen and bladder, which could be relieved only by morphia, and even then she could sleep only propped up with pillows. Cover slips from the throat showed large numbers of streptococci, and the urine contained traces of albumin. The uterus remained so tense that satisfactory palpation was impossible, but the presence of a ballottable head in the left flank suggested a transverse presentation. At no time could two fœtal hearts be heard.

During the night of Nov. 8th the patient complained of severe abdominal pain, but the uterine contractions did not seem more marked than those occurring previously. The membranes ruptured spontaneously at 4 A. M., Nov. 9, and vaginal examination two hours later showed that the cervix had risen to the level of the fourth lumbar vertebra; its canal was intact and the external os closed. In the lower uterine segment, which bulged into the pelvic cavity, pulsating vessels could be felt, which imparted a thrill suggestive of a placental bruît. Half way between the symphysis and sacrum a definite transverse ridge could be distinguished in front of which the tissues appeared more spongy, so that it was thought that the placenta was implanted low down upon the anterior uterine wall. At this time the temperature was normal and the pulse 128.

As it appeared impossible to deliver the patient per vagina, except by means of Dührssen's vaginal Caesarean section, it was thought that delivery could be effected most conservatively by means of a classical Caesarean section. The operation, however, was not begun until 9 A. M. on account of some delay in obtaining a priest, by which time the maternal pulse had arisen to 144. Upon opening the abdomen it was found that the entire portion of the uterus visible above the upper angle of the scar was derived from the posterior wall, the fundus being firmly fixed to the scar by a short band of adhesions 4 or 5 cm. thick, while the anterior bridged over the superior strait. At the same time the entire organ was displaced to the left, and so twisted upon its axis that the median end of the right round ligament was adherent to the scar in the midline. After cutting through the adhesions, the enormous uterus was delivered through the abdominal wound, when it was found to be so pendulous that its long axis formed nearly a right angle with the spinal column. The incision was through the anterior uterine wall, which was unusually thin, and two children were delivered, one having presented in the L. Ac. I. D. A., and the other in the R. O. I. P. position. Hemorrhage was readily controlled by compression of the cervix, but at the same time the uterus contracted so poorly that it was necessary to massage it constantly while the sutures were being placed. After closing the uterine incision, the raw surfaces left after severing the adhesions were covered over with peritoneum, after which the abdominal wound was closed in layers of catgut.

The patient left the operating table with a pulse of 136, which shortly afterwards fell to 120 and maintained approximately the same rate until death occurred on the sixth day. After a preliminary rise to 102.6° the temperature varied between 99.4° and 101.8°, and the respirations between 28 and 38. The bowels were readily moved on the third day. At no time was there any abdominal distension, nor any signs of intestinal obstruction or peritonitis. The patient, however, slept poorly and took but little nourishment, and failed gradually, dying five and a half days after the operation. Autopsy was refused, but on inspecting the wound it was found that it had healed *per primam,* and presented no signs of infection. One of the twins was a boy and the other a girl, and weighed 4¾ and 3½ lbs., and measured 45 and 43 cm. respectively. The former developed in a satisfactory manner, but the latter died suddenly two and a half days after birth.

Both of the cases reported in this paper present several features which appear worthy of mention. In each instance the operation resulted in fixation of the uterus, being intentional in the first and unintentional in the second. In the second case it would seem that the patient had been operated upon during the first month of pregnancy, and it is probable that the increased vascularity of the uterus incident to the condition played a prominent part in the production of the abnormal adhesions. In each of my own cases the fixation was in the neighborhood of the fundus, but in neither of them was the pelvic inlet obstructed by a mass of uterine muscle, as is frequently observed, since in both the anterior wall of the uterus was normal in thickness. Both patients complained of almost constant pain, and were bedridden for several months before labor; and at the same time their uteri were so irritable that it was impossible to say at any given time whether labor was imminent or not. In each case the abnormal position of the cervix was noted during pregnancy and became accentuated during labor.

COMPLICATIONS OF PREGNANCY FROM VENTRO-FIXATION.

The complications of pregnancy which may be ascribed to ventro-fixation vary greatly in degree, and doubtless depend upon the extent and length of the adhesions which fasten the uterus to the abdominal wall. Fortunately, in many cases, even though the adhesions be firm and dense, little or no difficulty is experienced, while in others, adhesions of the same character may give rise to serious complications, which have been tabulated by Kelly as follows:

1. Marked retraction of the scar due to the tugging of the adherent uterus.
2. Constant hypogastric pain.
3. Retraction and displacement of the cervix, even up into the abdominal cavity.
4. Formation of a tumor obstructing the pelvic inlet, resulting from hypertrophy and deficient expansion of the anterior uterine wall.
5. Excessive thinning of the posterior wall of the uterus.
6. Abortion or premature labor.
7. Persistent and excessive nausea.

During labor the following complications may be noted:

1. Prolongation of pregnancy.
2. Inertia of the uterus due to excessive thinning of its walls.
3. Dystocia due to the tumor formed by the contracted anterior wall of the uterus.
4. Inability of the cervix to dilate, owing to its abnormal position.
5. Increased frequency of abnormal presentations.
6. Rupture of the scar of fixation.
7. Rupture of the uterus.

Noble, in 1896, collected from the American literature 56 cases of pregnancy following 808 operations for ventro-fixation or suspension of the uterus, in which at least one ovary remained. At the time of his report 6 patients had aborted and 43 had gone on to term, with 3 deaths; one patient having died from heart disease before labor, the second from infection occurring before delivery, and the third from infection following a Porro-Caesarean section. As the first two deaths could hardly be attributed to the operation, he figured out a mortality of a little over 2 per cent, although it would appear that one of the other patients, who was undelivered at the time of the report, died subsequently.

Later, in the same year, Dorland tabulated 179 cases of pregnancy following these operations, and adduced a number of interesting observations; thus, in only 38 per cent of the cases did both pregnancy and labor pursue an uncomplicated course, although pregnancy was normal in 67 per cent and labor in 62 per cent of the cases, with 9½ per cent remaining undelivered. After deducting the latter, and the 14 per cent of cases which ended in abortion or premature labor, there remained for consideration 137 cases which presented the following abnormalities:

Retraction of the cervix to the level of the promontory or higher	10 cases	(7 per cent)
Threatened rupture of the uterus	9 "	(6.5 per cent)
Abnormal presentations (6 transverse)	9 "	(6.5 per cent)
Serious dystocia	23 "	(17 per cent)
Post-partum hemorrhage	3 "	(2.2 per cent)
Retained placenta	3 "	(2.2 per cent)

The cases presenting serious dystocia were delivered by forceps in 11 instances and by version in 9; while Caesarean section became necessary in one case—8 per cent, 6.5 per cent and 2 per cent respectively; while the fœtal mortality was 18 per cent and the maternal 1.5 per cent, leaving out of consideration the deaths which were not directly due to the operation.

In addition to the case reported in this paper, I have collected 20 others from the literature, in which Caesarean section was necessary, and in all but one of them the data were more or less complete. Thus, in the 20 cases of which the number of antecedent labors was mentioned, we find that 4 patients had 1, four 2, three 3, two 4, and the others 5, 7 and 9 children, respectively, while four were pregnant for the first time. In 12 cases the time was given at which the membranes ruptured. This occurred at or before the onset of labor in 9 cases, after four and a half and fourteen hours respectively in two other cases, while one patient was delivered by Caesarean section before the membranes ruptured. In 17 cases the time was given which elapsed between the onset of labor and the Caesarean section, 2 cases going four hours, 4 eight to twelve hours, 4 twenty to twenty-four hours, 2 two days, 2 four days, and 1 five days, while another case was operated upon two weeks after rupture of the membranes, twenty-four hours after the onset of hard labor; while in the seventeenth case the operation was performed before the onset of labor, and after futile attempts to induce it by manual dilatation of the cervix and the use of the rubber bag. Moreover, it is interesting to note that in 7 cases some manipulation other than external version was attempted before resorting to Caesarean section.

In each of the 19 cases in which the position of the cervix was mentioned, it was situated above the promontory of the sacrum, and in 2 cases at so high a level that it could not be reached by the fingers. Among the other data the following facts may be mentioned: The pelvis was normal or only slightly contracted in every case but one, twins were noted twice, transverse presentations in 15, vertex in 3, and breech in 2 cases; while in 3 others the position was not given. Eight mothers died (38+ per cent), while in the 18 cases in which the result to the fœtus was noted, there were 8 deaths, a mortality of 44½ per cent. The conservative Caesarean section was performed in 14, and the Porro operation in 6 cases, with four deaths following the former and three the latter operation; while no particulars were given concerning the remaining fatal case.

While searching the literature for reports of cases of Caesarean section following ventro-fixation and suspension, I have met with the records of many other cases, in which the dystocia was attributable to abnormal fixation of the uterus, and which required delivery by forceps or version; but I have made no attempt to collect them, or the cases of death from rupture of the uterus, in which delivery was not effected; and would refer the reader, who may be interested in this accident, to the reports of Dickinson, Mackenrodt, von Guérard, Noble, Broadhead and Morrill. I might also mention that instead of attempting Caesarean section, laparotomy was performed in at least two other cases and the adhesions freed, after which delivery was effected in one case through the natural passages.

Admitting that the cases of Caesarean section referred to constitute but a small proportion of the total number of pregnancies occurring after ventro-fixation, the results following the operation are, nevertheless, so serious as to warrant careful consideration, and to lead one to inquire how they may be improved or prevented.

In the majority of cases the fixation was intentional, as the uterus had been sutured directly to the abdominal wall; though it is probable that in certain of them other operative procedures, carried out at the same time, contributed to the formation of denser and firmer scars than was originally intended. On the other hand the advocates of ventro-suspension have claimed that the adhesions created by that operation are never firm or resistant enough to complicate pregnancy or labor, and it must be admitted that in the hands of competent operators this is almost universally the case. Yet, at the same time, it occasionally happens that from one cause or another, the area of adhesions may be increased, and the intended suspension may be converted into a fixation. Such a result may be attributed to lack of operative skill and faulty technique, suppuration of the abdominal wound, intensification of the adhesions from other operative procedures, or the increased vascularity of a pregnant or puerperal uterus. That the latter condition may occasionally be the cause of fixation is apparent from the consideration of my second case, and one other which I recently observed in the lying-in ward of the Johns Hopkins Hospital. In both instances ventro-suspension had been performed when the operator was unaware of the existence of pregnancy, the operation being complicated by the removal of a dermoid cyst and the stitching in place of a floating right kidney in the latter case. Fortunately, dystocia did not occur, although definite fixation resulted.

TABLE OF CASES.

Reported by.	Age.	Previous full term Pregnancies	Time Elapsed since Operation before Delivery.	Operation Previously Performed.	Pelvis.	Presentation.	Duration of Labor before Section.	Time of Rupture of Membranes.	Position of Cervix.	Previous Manipulation.	Caesarean Section.	Maternal Result.	Fœtal Result.
Abel	35	1	3 years.	Ventro fixation.	?	Vertex.	41 hours.	Onset of labor.	High and posterior.	Vaginal examinations.	Porro.	Recovery.	*Dead born.*
Batchelor	22	1	1 year.	Ventro fixation.	Normal.	Transverse.	12 hours.	Onset of labor.	High above promontory.	Many vaginal examinations.	Conservative.	*Death.*	*Dead born.*
Bidone	22	2. One after Caesarean case of Pinzani.	3 years.	Ventro fixation.	Normal.	Transverse.	?	Patient did not remain in hospital, but left against advice and was delivered outside by "Caesarean section."				*Death.*	*Death.*
Bidone	?	2	3 years.	Ventro fixation and ovariotomy.	?	Transverse.	9½ hours.	After 4½ hrs. of labor.	2 cm. above promontory.	Vaginal examinations.	Conservative.	Recovery.	Living.
Bloomhardt	43	4	6 years.	Ventro fixation.	?	Transverse.	4 days.	Onset of labor.	Above promontory and posterior.	Attempt to bring cervix into pelvic axis	Porro.	*Death.*	*Death.*
Brown	37	0	1½ yrs.	"Some form of ventro suspension."	Normal.	Transverse.	4 hours.	Onset of labor.	Not felt.	Vaginal examination only.	Conservative.	Recovery after temperature of 104 on 6th day.	Living.
Cragin	27	0	4 years.	Ventro fixation.	?	Transverse.	One day.	Early in labor.	High up and posterior.	Vaginal examination only.	Conservative.	Recovery.	Living.
Dickinson	31	0	4 years.	Ovariotomy and ventro suspension.	Normal.	Twins in breech and vertex.	Not in labor.	Not ruptured.	Ext. os at first lumbar vertebra internal os not reached through cervical canal 10 cm. in length.	Attempt to dilate cervix and induce labor with rubber bag.	Conservative	*Death.*	Living.
E[illegible]s	[illegible]	4	2 years.	Ventro fixation after unsuccessful attempt at Alexanders operation in which left round ligament was ruptured.	?	Transverse.	?	?	High and posterior.	? Rupture of Uterus.	Porro.	*Death.*	*Death.*
Goubaroff	23	0	4 years.	Ventro fixation.	Normal.	Transverse.	Four days.	?	High and posterior.	Laparotomy to release adhesions. Haemorrhage necessitated Caesarean.	Conservative.	Recovery.	Living.
Ill	29	2	2 years.	Ventro-fixation and perineal plastics.	?	?	2 weeks (?) 24 hours of hard labor.	At onset of pains.	Above promontory.	Vaginal examination only.	Conservative.	Recovery.	*Death on first day.*
Ill	25	3	5 years.	Ventro fixation and perineal plastics.	?	?	5 days.	?	Not felt.	Vaginal examination only.	Porro.	Recovery.	*Dead born.*
Ill	42	?	1½ yrs.	Ventro fixation and perineal plastics.	?	Transverse.	2 days.	?	"High in pelvis."	Vaginal examination only.	Conservative.	Recovery.	Living.
Lynch	35	9	8 mos.	Ventro suspension during pregnancy.	Normal.	Twins in vertex and transverse.	4 hours.	Onset of labor.	High above promontory.	One vaginal examination.	Conservative.	*Death.*	One living. *One death on 3rd day.*
Müller	32	3	2 years.	Ventro fixation and perineal plastics.	?	?	?	?	?	?	?	*Death.*	?
Neber	35	5	1 year.	Ventro fixation and salpingo oophorectomy.	?	Breech.	24 hours.	Onset of labor.	Level of promontory and posterior.	Attempt to dilate cervix and bring down foot.	Porro.	*Death.*	Not given.
Pinzani	26	1	1 year.	Ventro fixation and salpingo oophorectomy.	Normal.	Transverse.	20 hours.	After 14 hours of labor.	Level of promontory and posterior.	Attempt at internal version.	Conservative.	Recovery.	Living.
Pozzi	?	3	1 year.	Ventro fixation. oophorectomy.	?	Transverse.	?	Onset of labor.	Dislocated posteriorly.	?	Conservative.	Recovery.	Living.
Rapin	21	1 forceps. 1 premature induced labor.	1 year.	Ventro-fixation.	Contracted conjugata vera 9 cm.	Transverse.	12 hours.	?	Very high posterior.	Vaginal examination only.	Conservative.	Recovery.	Living.
Schutte	?	7	5 years.	Ventro-fixation and salpingo oophorectomy.	Normal.	Transverse.	8 hours.	?	Very high.		Conservative.	Recovery.	Living.
Werder	24	1	4 years.	Ventro fixation and perineal plastics.	?	Transverse.	1 day.	?	Level of promontory.	Attempt to bring cervix into pelvic axis.	Porro.	Recovery.	?

The vascularity of the puerperal uterus may act in a similar manner, as was illustrated by another case coming under my observation, in which it was attempted to suspend the uterus seven weeeks after labor. At the operation the sutures repeatedly cut through the friable uterine tissue, so that considerable manipulation was necessary. As a consequence, when the patient recovered, the uterus was found to be firmly adherent to the anterior abdominal wall, instead of merely suspended from it. That neither of these favoring circumstances are absolutely necessary to the formation of dense adhesions, was shown by another case in which the uterus, although suspended by a competent operator, in the absence of any abnormality save displacement, became firmly fixed to the abdominal wall. This patient entered the lying-in ward when eight months pregnant, and presented dense adhesions between the uterus and abdominal wall, which were readily palpated. They stretched but little during pregnancy, and prevented the uterus from rising in the normal manner. Fortunately, the roomy pelvis compensated for this, and dystocia did not occur; though at the time of labor the cervix appeared at the vulva, where its dilatation could be followed with the eye.

The cause of dystocia in all these cases can be readily understood upon considering the anatomical conditions resulting from the operation. Thus, if the fundus be firmly attached just above the symphysis by dense adhesions, the anterior uterine wall will be unable to expand, and consequently the increase in size of the organ must be effected altogether at the expense of its posterior wall. As the ascent of the fundus is thus impeded, the foetus tends to accommodate itself in an oblique or a transverse position, and by its further growth causes the posterior wall to become so thin as to approach the verge of rupture. At the same time the tension exerted by it tends to draw the cervix upward from its normal position, until it comes to lie in the neighborhood of the sacral promontory. Moreover, in a certain number of cases the thickened anterior uterine wall may form a tumor which obstructs the superior strait, and it would appear probable that such a condition is more apt to occur when the fixation is by means of the posterior wall of the uterus, since it was absent in the two cases here reported, in which fixation was by the anterior wall.

In such cases, in the latter months of pregnancy, dense adhesions can be palpated extending from the abdominal cicatrix to the body of the uterus, and as pregnancy advances the scar may become retracted. At the same time, when the round ligaments are palpable, their upper extremities will be found in the neighborhood of the upper end of the scar, thus showing that the fundus is in the neighborhood of the symphysis, instead of at the vertex of the uterine tumor.

At the time of labor, dilatation of the cervix is effected very imperfectly, if at all; since the bag of waters and the presenting part, instead of impinging directly upon the internal os, exert their force upon the portion of the uterus anterior to it, and consequently, no matter how strong the contractions may be, labor comes to a standstill, and unless suitable operative interference is undertaken, rupture of the uterus must become imminent.

TREATMENT.

Considerable discussion has arisen as to the most suitable means of treating this class of complications when observed in pregnancy, and the following methods have been advocated:

(a) Induction of premature labor;

(b) Freeing the adhesions after laparotomy;

(c) Allowing the patient to go to term, and should dystocia occur, to attempt delivery by forceps or version, after manual or instrumental dilatation of the cervix, or if necessary, to perform the classical Caesarean section or Dührssen's vaginal operation.

It seems to me that the field for the induction of premature labor is extremely limited for three reasons: In the first place, it does away with the possibility of spontaneous labor at term; and secondly, it is associated with a tremendous foetal mortality. Moreover, the operation may prove extremely difficult in the cases in which it may be indicated, and in some instances prove impossible of accomplishment.

The performance of laparotomy followed by the freeing of adhesions is indicated only in the exceptional cases in which the patient is seen early in pregnancy, and complains of intense abdominal pain. On the other hand, when the patient is only seen before labor, the procedure is contraindicated for several reasons: In the first place, a large wounded area will be left on the uterus, which must be covered over by peritoneum, and thereby greatly increase the chance of premature termination of pregnancy. Moreover, in the second place there is considerable doubt as to the advisability of allowing a uterus, which has recently been subjected to so severe a procedure, to stand the strain of labor; not to speak of the fact that the freshly formed abdominal cicatrix may be severely damaged.

As far as I can ascertain, Goubaroff and Bidone attempted such a procedure after the onset of labor, in the hope that spontaneous delivery would follow; but their results were not sufficiently encouraging to tempt one to imitate them, for, in the former's case, the hemorrhage was so severe that Caesarean section became necessary to prevent the woman from bleeding to death; while in the latter's the procedure was not followed by the desired result, and it later became necessary to dilate the cervix manually, after which version was performed and extraction attempted. As this could not be accomplished, craniotomy was resorted to, and even then the child was delivered only after the greatest difficulty, and the mother developed a peritonitis which nearly cost her life.

Dührssen's vaginal Caesarean section, or the modification proposed by Hübl, has been practiced in a number of cases of dystocia following vagino-fixation of the uterus, in which manual dilatation of the cervix was out of the question. It would appear, however, that in the class of cases under consideration, the danger of hemorrhage is considerable after this operation, and may be so profuse as to make it necessary to sacrifice the uterus in order to prevent death. And, moreover, the adhesions which gave rise to the condition cannot always be readily separated through the vagina, and therefore should the woman recover, she may be exposed to a similar danger in a subsequent pregnancy.

In view of the various considerations just advanced, it would seem to me a better practice to allow the patient to go on to term, unless the pain in the region of the abdominal cicatrix be so severe as to demand relief during pregnancy. If, at the time of labor, the fixation is dense and the cervix displaced above the level of the sacral promontory, I believe that the best results will be obtained by resorting to Caesarean section at the onset of labor, and without any attempt at delivery through the natural passages. In such cases, after releasing the adhesions the operation is readily performed, and should give satisfactory results, provided it is done by a competent operator under suitable surroundings.

Up to the present time, however, the mortality following such operations has been extremely high, and would seem to be due to infection contracted during intra-uterine manipulations which had previously been undertaken; though, in the few cases in which the operation has thus far been performed primarily, the condition of the patient was so serious as to make its outcome very doubtful. Whether the results of Caesarean section, for this variety of dystocia, will ever be as favorable as those performed for pelvic contractions, remains to be seen; but there is no reason why they should be anything like so serious in the future as they have been in the past.

In conclusion, I think it should be inquired whether operations likely to result in fixation of the uterus to the anterior abdominal wall are ever justifiable during the childbearing period. The untoward results following ventro-fixation clearly indicate that the operation should be abandoned; while the few cases in which unintentional fixation has followed supposed suspension of the uterus, render it questionable whether even this more conservative operation should be employed. For my part, I am inclined to take the ground that neither procedure is justifiable until after the menopause, as it does not seem proper to undertake an operation for the cure of a condition which does not threaten the life of the patient and merely exposes her to a certain amount of discomfort, when we know that it may give rise to most serious dystocia should she become pregnant.

Which will prove the most suitable operation for the cure of displacements of the uterus during the childbearing period cannot as yet be definitely predicted, though it seems to me that some of the procedures which aim to maintain the organ in position by shortening the round and the utero-sacral ligaments, will eventually prove to be the operation of choice. It is possible that Alexander's operation may prove the ideal procedure when the uterus is movable; but when it is adherent the abdomen must be opened, in order to free it, and under such circumstances some intra-abdominal method of shortening the ligaments would appear most rational.

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TWO CASES OF MULTIPLE SACCULAR ANEURYSMS OF THE AORTA WITH RUPTURE INTO THE PERICARDIUM.

By P. K. Gilman.

(Notes from the Pathological Laboratory of the Johns Hopkins Hospital.)

The following cases of multiple saccular aneurysm formation in the arch of the aorta with rupture into the pericardium have some anatomical interest, and are reported through the courtesy of Dr. W. G. MacCallum.

Case I.—C. S., a colored coachman aged 39, was admitted to the hospital several times during the years 1901-1903 with signs of aneurysm formation in the region of the arch of the aorta. There was great variation from time to time in the physical signs, the prominence caused by the aneurysm and the area of maximum pulsation being somewhat movable. During the last admission and up to the time of the patient's death there was present a well-developed tracheal tug and a leathery friction rub was heard in the left upper chest.

At autopsy a large irregular sac was found in the pericardial region densely adherent to the left lung, which in turn was compressed and bound firmly to the thoracic wall.

The pericardium was distended with blood which, in addition to being firmly clotted, was shown to be partly organized, the organization being more advanced at the apex than elsewhere. The clot was thickest over the base of the heart posteriorly and thinnest about the apex. The heart itself was generally hypertrophied, though its valves were delicate.

From the arch of the aorta there arose three aneurysmal sacs, the largest, 12 cm. in diameter, involving the anterior face of the vessel from 4 cm. above the valves to the origin of the innominate artery, the second, 6 cm. in diameter, involving the convex portion of the arch and giving off the innominate, left carotid, and subclavian arteries, the third, 2.5 cm. in diameter, springing up from the descending aorta about 2 cm. below the second.

The largest of these sacs extended downward and to the left, compressing the right auricle downward and backward. It was lined in its lower portion by a firm laminated clot 2 cm. thick. In its lower right portion was an irregular ragged slit which communicated with the pericardium, and through which the hæmorrhage had occurred.

The second aneurysm had compressed the left bronchus and had given rise to a generalized bronchiectasis in that lung, which, in addition, had undergone a very extensive tuberculous consolidation. The right bronchus had suffered no compression, and the lung was voluminous with widely dilated air cells.

This case, aside from the anatomical peculiarities, is chiefly interesting from the fact that the extensive hæmorrhage into the pericardium had been survived long enough to permit partial organization of the clot.

Case II.—E. L. W., a negro aged 43, who died with signs of aortic aneurysm and pulmonary tuberculosis. At autopsy there was found disseminated tuberculosis of both lungs with extensive caseation of the bronchial and peritracheal lymph glands.

The pericardium was much thickened and hæmorrhagic, and was covered with ragged fibrous adhesions. Its cavity was distended with a laminated clot, showing some organization where it adhered to the pericardial surfaces. But for a general hypertrophy the heart was not greatly altered, though the aorta was enormously dilated from a point 3 cm. from its origin, the dilatation measuring 9 cm. in diameter. This was rather an aneurysmal dilatation than a saccular aneurysm. The walls of the dilatation were roughened by irregular patches of sclerotic thickening of an extreme grade, though there was no calcification. There were several irregular saccular bulgings of the walls, reaching sometimes 2 cm. in diameter, and filled with thrombus masses. At the upper part of the ascending portion of the aorta one of these sacs had ruptured, and the opening, about 2 cm. in diameter, bore a lobulated corrugated thrombus mass. A probe passed through this opening entered a cavity hollowed out in one of the large caseous bronchial glands and thence passed into the pericardium, showing the path of the hæmorrhage into the pericardium.

Sections of the pericardium showed a well-developed tuberculous pericarditis, and it seems probable that the path ultimately followed by the stream of blood may have been the original path followed by the tubercle bacilli in their spread from the lymph glands to the pericardium.

REPORT OF RESULTS OF NURSING DISPENSARY TUBERCULAR PATIENTS.

By R. Thélin,

Visiting Nurse for Tuberculosis.

The results of three months' visiting of tuberculous patients from the Johns Hopkins Hospital Dispensary are, on the whole, encouraging. The work is as yet retarded by the need of a room where a separate clinic can be held, but this want is soon to be filled, we hope, through the generous donation of Mr. Henry Phipps.

Under the present arrangement, the nurse is not able to be present at the clinic, but is given the names of the patients by the doctors in the dispensary. She also accepts names from the Federated Charities, and, if possible, brings those patients to the dispensary for a definite diagnosis.

The majority of the dispensary cases are from the laboring classes, many of them intelligent working men, who have spent their all on doctors or on quack medicines. They say that when they had money to pay a doctor, they did not think it right to go to a free dispensary. Now, their money gone, they come to the dispensary, too late, in many cases, to be saved! In many instances they receive the new ideas with favor and after trying the experiment of sleeping with an open window, generally feel so much better that they are more than willing to continue it. Out of sixty-five cases seen, thirty-eight have been willing to sleep with their windows open, and are continuing it more or less faithfully.

In the winter months it has been more difficult to get tubercular patients out in the day-time, either from weakness and lack of energy on their part, or from lack of proper clothing when they had the energy. Nor has the plan of sitting with open windows, well wrapped up, been very successful as yet.

The doctors urge the patients to go to the country, if possible, and in nine instances they obeyed so promptly that they were gone before the nurse could get to see them. As the Hospital for Consumptives at Towson can accommodate only twenty-five patients we usually find out whether the patients can make arrangements to go to friends in the country before considering Towson as a possibility. We have sent four white patients there, and three colored patients to the Hospital for Tuberculosis at Bay View.

As regards diet, the help afforded by the Federated Charities is immeasurable. Thirteen patients only are able at present to supply themselves with the necessary quart or more of milk daily, but twenty-eight are daily supplied with one quart of good milk and two fresh eggs by the Federated Charities. They have also supplied a cot for a colored boy who was sleeping with his mother and sister. In another case of this sort, the boy was sent to Bay View.

The precautions to prevent the spread of infection are generally taken up by the family with great care. Sometimes a feeling of disgust and fear of the poor patient has developed on the part of friends and neighbors which has added to his already too heavy burden. Strange as it may seem, there is also a certain class of tubercular patients who, becoming embittered by their hard fate, refuse to be considered as sources of infection to others and strenuously oppose the efforts of their families to protect others from the disease. The existence of this class points to the necessity of such stringent laws as are now being enforced in New York.

Our health authorities have not done much in the matter of legislation against tuberculosis as yet. Even fumigation is not compulsory; the request to have a tuberculous house fumigated must be accompanied by a signed order from the owner or tenant. Notwithstanding our discouragements there is ground for hope in the fact that the work of visitation has been begun, and that four patients are undoubtedly gaining in weight and strength as a result of it. Two of these, who were too weak to walk one block, are now able to attend to their ordinary housework. One recently walked two miles, and hopes soon to be strong enough to go to work.

Report of Work for Three Months.

Total number of visits for December	72
" " " " " January	86
" " " " " February	87
Total for three months	245
Dispensary Patients	42
Patients from Federated Charities or interested persons	25
Not seen because of wrong address	11
" " " gone to the country	9
" " " sent to hospital	3

THE JOHNS HOPKINS HOSPITAL BULLETIN.

The Hospital Bulletin contains details of hospital and dispensary practice, abstracts of papers read, and other proceedings of the Medical Society of the Hospital, reports of lectures, and other matters of general interest in connection with the work of the Hospital. It is issued monthly.

Volume XIV is now completed. The subscription price is $2.00 per year. The set of fourteen volumes will be sold for $50.00

PROCEEDINGS OF SOCIETIES.

THE JOHNS HOPKINS HOSPITAL MEDICAL SOCIETY.

December 7, 1903.

The meeting was called to order by the President, Dr. Futcher.

Perineal Zoster. Dr. Cushing.

An herpetic eruption rarely occurs over the sacral areas. According to Head's tabulation of 378 cases, in seven instances only did the eruption have a sacral distribution, the lowest segment of which mention is made in his paper being the third sacral.

Fig. 1.

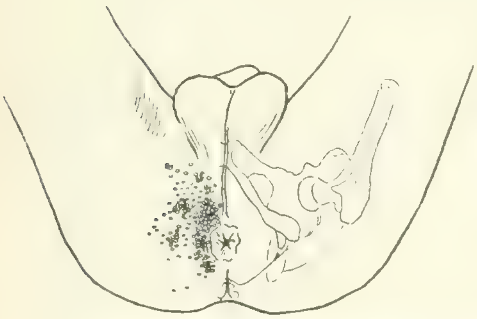


Fig. 2.

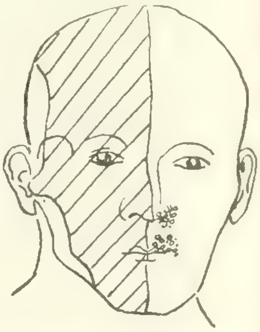
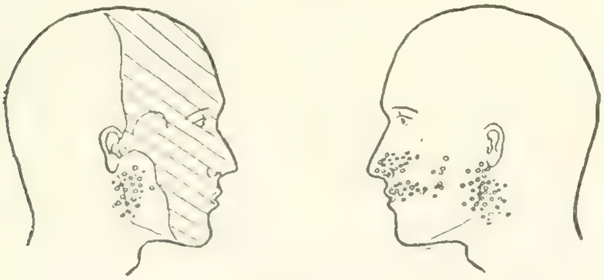


Fig. 1.—Outline sketch of area of vesiculation over perineum in Case I.

Fig. 2.—Diagram showing postoperative area of anæsthesia in Case I, with an outcrop of herpes facialis on the opposite side.

Fig. 3.



Case II.—Distribution of facial and bilateral cervical herpes. Note that the postoperative anæsthetic area remains free, indicating that the eruptions presumably originated from lesions in the posterior root ganglia (cervical and trigeminal).

Twice, in the writer's series of cases of trigeminal neurectomy, has the operation been followed by an outcrop of herpes. In the first case the distribution of the vesicles on the perineum was taken to represent a lesion of the fourth sacral posterior root ganglion (cf. Fig. 1). There was an accompanying vesiculation of the herpes febrilis type on the non-anæsthetic side of the face (Fig. 2). In the second case sensory symptoms, such as are the frequent precursors of herpes zoster, appeared after the operation, having a bilateral perineal distribution similar to that in the first case. The symptoms were interpreted as indicating a lesion of the posterior root ganglia (S. iv.), which did not suffice to cause vesiculation; "herpes zoster" without eruption, as described by James Mackenzie. This perineal disturbance was accompanied, as in the first case, by a quite extensive facial herpes which again failed to encroach upon the skin-field rendered anæsthetic by the ganglion extirpation (Fig. 3).

The pathology of herpes facialis seu febrilis has been the occasion of dispute. Many have thought the lesion to be quite distinct from that which produces true herpes zoster. Howard, however, has found lesions in the Gasserian ganglion in a case of common facial herpes accompanying pneumonia. This observation together with those above cited, that after Gasserian ganglion extirpation an herpetic eruption does not occur over the resultant anæsthetic field, suffices to render it most probable that posterior-root ganglion lesions are responsible for the common forms of herpes about the lips and nose as well as for zoster.

The perineal eruption in the first case and the hyperæsthetic area in case two with a similar distribution, allow of certain generalizations as to the cutaneous skin-fields of the lower sacral segments. In the ordinary diagrams with the subject in the erect posture the lower (fourth and fifth) sacral fields are completely hidden. It is necessary to put the body and lower extremities in the embryonal position in order to understand clearly the configuration of the skin-fields below the second sacral, this being the lowest to enter completely into a leg distribution. The coccygeal, fifth, fourth and third sacral areas surround the caudal end of the body in concentric fashion, the strips running from mid-dorsum to mid-venter just as do the thoracic and abdominal skin-fields, and like these retain in large measure their simple, primative and undistorted arrangement.

Notes on Hydatid Disease in Australia. Dr. J. Ramsay, of Launceston, Tasmania.

Dr. Ramsay gave an account of hydatid disease in Australia, where it occurs more commonly than in any other country in the world except Iceland. Dogs, rabbits, kangaroos and oxen are affected. The chief source of infection in man is from the feces of dogs. The successful treatment is surgical and consists in a removal of the hydatid cysts.

Discussion.

Dr. Cushing.—I was very much interested in what Dr. Ramsay said about the rarity of hydatid in the spine. One of the very few cases of hydatid I have seen operated upon was one in which multiple cysts in the spinal canal had been the cause of a pressure palsy. The case was operated upon by Sir Victor Horsley a few years ago in London.

Dr. McCrae.—We are indebted to Dr. Ramsay for this excellent paper. Hydatids are of course rare in this locality, but it is well to be on the lookout for them. It is interesting to see how exploratory puncture has fallen into disfavor for the diagnosis of hydatids. Twenty-five years ago puncture was done in appendix conditions, ten years ago for distended gall bladder, and I suppose ten years hence many of the punctures done now will have been abandoned.

Dr. Futcher.—Hydatid disease is undoubtedly rare in this country. Dr. Lyons' statistics were referred to by Dr. Ramsay. He found that up to 1902 there had been 241 cases reported in this country, only one of which was known to be a native-born American. In 136 the patients were foreigners. In 92 the nativity of the patients was not known. Ten were negroes and two were Canadians.

It is interesting to note that there were 56 cases in the Province of Manitoba, Canada. The explanation for this is that there is a large settlement of Icelanders in that province, and hydatid disease is very common in this race. Only one instance is known in a Canadian-born offspring of an Icelandic emigrant.

Dr. Ramsay.—Our statistics of hydatid of the kidney are a little different from those usually compiled. Neisser found 8 per cent, I believe, but with this exception it is said to have been rare. You are to be congratulated upon knowing nothing about hydatid in this country. I advise you to keep the disease out of the country.

Intra-pelvic Hematoma following Labor. Dr. Williams.

I wish to report a case which I saw in consultation about a month ago with Dr. H. L. Smith, which was of great interest to me, both on account of its rarity and the favorable result following operation.

I saw the patient on the evening of November 2, 1903, and obtained the following history:

Thirty-three years old, married three years, and had been delivered a few hours previously of her first child, which weighed a little less than six pounds. The labor was quite slow and was terminated by an easy low forceps operation without anæsthesia. The statements concerning the delivery were made by the nurse, as Dr. Smith did not deliver the patient himself, being called in some hours later in the absence of the regular medical attendant. The placenta was expelled shortly after the birth of the child and everything seemed to be most satisfactory. There was no hemorrhage. Almost immediately after delivery the patient began to complain of intense pain of a tearing character about the rectum, which was so severe as to require the administration of a hypodermic of morphia. The patient stated that this pain was more intense than any she had felt during labor. Her general condition was good, as was evidenced by the fact that her physician, who lived in the country, left her at the end of an hour, saying he would see her the next day.

After his departure, the pain became much more severe and the patient gradually passed into a condition of collapse. Three hours after delivery she was seen by a neighboring physician, and later by Dr. Smith. At that time she was greatly shocked, pulse 160-70, and complained of intense pain. After the subcutaneous injection of normal saline solution and the administration of strychnia and whiskey, her condition improved somewhat, but soon changed for the worse, when a diagnosis of internal hemorrhage was made, and I was asked to see her.

The patient was a large, well-nourished woman, with a very pallid face and a rapid thready pulse of 160. On palpation, the lower abdomen was filled by a rounded fluctuant tumor, the size of a man's head, reaching up to the umbilicus. At first glance it seemed to be the enormously distended bladder, but only a few drops of bloody urine could be obtained on catheterization, while the tumor maintained its original size. Careful examination then showed that it was surmounted by a hard, rounded body about the size of two closed fists, which was clearly the contracted body of the uterus. On vaginal examination, the posterior and left vaginal fornices bulged markedly, and through them a wave of fluctuation could be transmitted to the abdominal tumor. The cervix showed no signs of a tear, and was displaced upward and backward, so that the external os lay to the right of and just in front of the sacral promontory.

In the absence of external bleeding in a patient presenting the symptoms of acute anæmia, the only possible diagnosis was internal hemorrhage, which was supposed to be due to an incomplete rupture of the uterus, with escape of blood between the folds of the broad ligament.

As the patient's condition had become worse in the interval between my arrival and the completion of the examination, I recommended immediate operation, laying clearly before the family the dangers of such a procedure, but pointing out at the same time that it offered a much greater chance of success than expectant treatment. Accordingly, preparations were made for a laparotomy, the necessary appliances being transported from the hospital. This necessitated considerable delay, so that the operation could not be begun until 1 A. M. At that time the patient was practically pulseless at the wrist, though the heart could be distinctly heard on auscultation. Only a minimum amount of ether was necessary to anæsthetize her.

After the usual preparations, an incision was made in the middle line of the abdomen extending 15 cm. upward from the symphysis. On cutting through the fascia, the ordinary components of the abdominal wall could not be distinguished, and a loose, blood-stained tissue came into view, which was readily broken down by the fingers. Then, instead of reaching the peritoneum, the fingers passed directly into a large cavity, filled with partially clotted blood, situated between the symphysis pubis and the anterior and inferior wall of the bladder, and extending between the folds of the broad ligament to the left wall of the pelvis. It was bounded below by the pelvic floor, so that the fingers emerged beneath the ascending ramus of the ischium anteriorly, while laterally they came in contact with the tuber ischii. Being still under the impression that I had to deal with a ruptured uterus, I extended the abdominal incision upward and exposed the body of the uterus, which was perfectly normal, except for its unusual position. To make the matter absolutely sure, however, I requested an assistant to pass his finger up through the cervix, when it was found that there was absolutely no communication between the uterine canal and the cavity just described. The peritoneum above the hematoma was then closed, so as to prevent any contamination of the abdominal cavity, and the hematoma rapidly cleared of the clots contained within it. An attempt was then made to locate the source of the hemorrhage, which was found to be from an oozing surface upon the anterior and inferior surface of the bladder, there being no large vessels involved. As it was impossible to apply ligatures, the only means of checking the hemorrhage seemed to lie in packing the cavity with iodoform gauze. This was accordingly done, the vagina being tightly packed at the same time, so as to afford counter pressure.

The abdominal wound was then closed to within 5 cm. of the symphysis, a tight abdominal bandage applied and the patient put to bed in slightly better condition than at the beginning of the operation. During the night she rallied considerably, and by the following morning was practically out of danger. At that time the dressings were so soaked with a bloody discharge that it was necessary to renew them, though the packing was allowed to remain in situ for three days before it was replaced. At that time, a sound introduced into the wound extended downward and backward on the left side of the pelvis for a distance of 10 inches. The wound rapidly closed, so that a smaller pack was used at each dressing, and at the present time all that remains of it is a small sinus three inches long and only large enough to admit a lead pencil.

Intra-pelvic hematoma following labor is extremely rare, hardly more than twenty cases being reported in the literature. The first clear description of such a condition is to be found in Deneux' monograph upon puerperal hematoma (1830), in which it was pointed out that such structures could be divided into two great groups, according as they were situated below or above the pelvic floor, the former being comparatively frequent and the latter extremely rare. Hugenberger in 1865 published a communication upon the subject, in which he reported five cases of his own and collected ten others from the literature. Since that time only isolated cases have been recorded, the great majority of which died, though a few recovered spontaneously. As far as I have been able to learn, this is the first case of the kind upon which an operation has been done, and I feel that the result justified its performance.

It would appear probable that the cause of the hemorrhage was due to tearing through the ante-vesical plexus of veins during the forceps operation, although it was not necessarily responsible for it, as several cases have followed normal and spontaneous delivery.

As far as diagnosis is concerned, it would appear impossible for one to differentiate between the condition in question and an incomplete rupture of the uterus, though this is practically a matter of comparative indifference, as in either event, operative interference is demanded if the hematoma increases in size and the patient's condition is at all serious.

Meeting of December 21, 1903.

The meeting was called to order by Dr. Hurd, the President arriving later.

Observations on the Coagulation of the Blood. DR. T. R. BOGGS.

Dr. Boggs showed an instrument for timing the coagulation of the blood which was a modification of the apparatus first devised by Brodie and Russell, and gave relatively good results.

DR. MCCRAE.—We are all very much indebted to Dr. Boggs for telling us about this method and I am sure we will welcome any simpler method than that now in use. I would like to ask him whether the length of coagulation time as taken by this method is approximately the same as that taken with Wright's tubes.

The observations upon gelatin as described are interesting. Clinically we have practically discarded the use of gelatin to increase the coagulability of the blood, certainly in aneurism cases. We believe in the local application of gelatin to bleeding surfaces.

The Limitations of Urinary Diagnosis. DR. R. C. CABOT, of Boston.

One of the ideals dearest to the student of medicine is the ideal of accuracy. I suppose there is no ideal to which any of us pay homage more regularly. In the attempt to stir ourselves out of the slough of vague guesses in which the practice of medicine has wandered so long, we catch at anything that seems to make for greater exactness in every department of our work, but although we know very well that we want exactness, I do not think we all know by any means what we mean by accuracy in clinical work and I want to say a few words about what I think that word means. It is a truism to say that exactness is relative and never absolute, and yet if we recognize that as a truism we would recognize a corollary of that, that accuracy is always relative to our purpose and what may be accurate enough for one purpose is not enough for another and perhaps too accurate for a third. Perhaps I had better say that misdirected exactness is a danger into which the better trained of the students of medicine in the present are prone to fall. The art of medicine is long and our life is short. We cannot too soon realize that we have got to be inexact somewhere and that the wise man is he who knows where to be accurate and where to get along without exactness. A well-known practitioner of Boston, whose name would be recognized by many of you, was visited by a patient who complained of gastric trouble. The doctor made an exhaustive examination of the abdomen, extracted the contents of the stomach, and analyzed them, measured the size of and marked out the position of the stomach, analyzed the urine, quantitatively, examined the blood, made an estimate of the hæmoglobin, and prescribed for the patient. The patient got no better. The doctor had been very accurate in certain directions, but he had been very inaccurate in taking the patient's history. It turned out that the patient was pregnant. Now the pregnancy could not have been determined by any method of physical examination, so far as I know, at the time he made his examination, but it might possibly have been determined by taking a careful history. The point that I want to make is that he chose the wrong place for his accuracy. Had he been more careful about the history and less so about the percentage of hæmoglobin, he would perhaps have done better. Misdirected accuracy, then, is possible, as you see from the illustration.

I should like to spend more time on this part of my subject, but must pass to the consideration of a subject upon which I believe that a large amount of misdirected activity is spent—the subject of urinary analysis. My main thesis, in brief form, is that a large part of the time now spent on urinary analysis is entirely wasted. I am speaking especially now of the urinary analyses in renal disease. I shall not speak of those used in diabetes and other diseases in which the kidney is not directly concerned.

Dr. Councilman, in a report on acute and subacute nephritis in 1897, said of urinary analysis that it does not give any sure information as to the type of renal lesion present. At that time I looked upon that statement as a surprising one, but it seems less and less surprising as my own experiences have accumulated. I will begin by giving the accounts of two cases that serve to illustrate my thesis:

Case I.—An Italian, 27 years old, was brought to the Massachusetts Hospital entirely unconscious having been taken from a vessel which had touched at several South American ports. No history obtainable. Temperature 102.8 with moderate leucocytosis and a slight amount of evidence of consolidation at the apex of the left lung. He had nothing wrong with the abdominal viscera so far as we could demonstrate. There was some retraction of the head and stiffness of the neck. Fourteen ounces of urine drawn by catheter showed a little over ½ per cent of albumen. The color was high but not distinctly bloody, and the specific gravity 1.017. The sediment showed the largest number of casts I have ever seen in any urine—from 10 to 20 in every field of a No. 5 Leitz. The character of the casts were mainly granular with a few epithelial. Prolonged examination of the blood excluded malaria. Yellow fever, cerebro-spinal meningitis and uræmia were considered. Lumbar punctures gave no growth. He died next day. Autopsy showed cerebro-spinal meningitis, and the diplococcus intracellularis of Weichselbaum was isolated. The kidneys showed absolutely nothing so far as Dr. Wright could determine; they were normal macroscopically and microscopically.

Case II.—More recently a patient entered the surgical wards of the Massachusetts Hospital for abdominal aneurism, as it turned out. It was an abdominal tumor without a clear diagnosis and an exploratory laparotomy was done. Prior to that operation the urine was normal, but immediately afterwards the urine fell to 15 ounces in the 24 hours and never rose above that amount. He died a week later. The urine after the operation was pale, turbid, with a specific gravity of 1.014, and contained .7 per cent albumin. Among the casts, which were very numerous, were many waxy or highly refractile. The diagnosis at the time of death was uræmia. At autopsy absolutely nothing was found in the kidneys, microscopically or macroscopically.

Now, although I had begun the study of this matter long before those cases came to my attention, they served to strengthen my interest. I have been all over the autopsy records of the Massachusetts Hospital since 1893 and I picked out all those in which any definite lesions in the kidneys were found post mortem. Then I went to the histories of those cases and tried to determine how often the lesion discovered could have been determined in life. Then I took the number in which the kidneys were found post mortem to be normal and tried to see whether their histories tallied with the findings. The total result of that study would be too long to go into here and I will only mention its application to three types of nephritis. I have taken account of no cases in which there was not careful examination of the kidneys by microscope and no cases in which the urinary analyses were in any way faulty. Perhaps I should say that I believed those urinary examinations were made with special care, for every man that goes out of Harvard knows a good deal about urinary analysis, even though he may know nothing else. The post-mortem examinations were all made by Dr. Wright.

Out of the 19 cases in which acute glomerular nephritis was found post mortem only five were recognized during life and those were the cases in which œdema existed. Chronic glomerular nephritis gives what at first appears to be a different story; of 17 cases post mortem, 15 were correctly diagnosed during life. But we must remember that the picture of this disease is unusually distinctive without any consideration of the urine. In many of these cases, although the diagnosis was made, I doubt if it could have been made from the urine. The urine showed no more in these cases than in the two cases I have described in which nothing was found post mortem. Of 37 cases of chronic interstitial nephritis, 14 were properly diagnosed as *some* type of nephritis; four were diagnosed as chronic interstitial nephritis, and the remainder were not diagnosed as any kind of nephritis at all.

Now I have given you these facts in the barest way, but I do not see any way of getting around them. The only other thing I want to do is to consider in more detail some of the points in which we have usually placed reliance in urinary diagnosis. In the first place, as to the presence of albumin. I have quoted you two cases in which a large amount of albumin was present without anything in the way of blood or pus in the urine to account for it and no nephritis found. That is a familiar enough fact, but not sufficiently insisted upon in teaching. I shall speak of another point that I trust I need not speak of here, but which needs to be spoken of in our part of the country, that is as to the amount of urine taken for a specimen without regard to the total amount of the 24 hours' secretion. Time and again I have seen teachers point with pride to the narrow zone of the nitric acid test and compare it with the thick zone period as seen earlier in the course of the same case. Now in many of those cases the difference was only due to the greater quantity of water. In regard to the presence of casts, I will only allude to the fact that in using the centrifuge machine you often get casts in what you had every reason to believe was normal urine. Again I will allude to the statistics published seven or eight years ago by F. C. Shattuck, who analyzed 1000 cases of persons apparently healthy and more than 40 years of age. He showed that more than 70 per cent of those persons had casts, and that without the aid of a centrifuge machine. You all remember Dr. Osler's article on the advantage of casts to persons more than 40 years of age. The two cases I referred to first go to show that the presence or number of casts does not go to prove the degree of kidney lesion.

Finally, I think the misdirected attempts to be accurate is shown in our part of the country most strikingly in the effort to estimate the urea and other solids, without any effort to ascertain the patient's general metabolism. I think 90 per cent of the examinations made for urea in the Massachusetts General Hospital are worthless because no study is made of the metabolism. Perhaps the cause for this is that we still cling to the idea that there is some relationship between urea and uræmia. We still treat the amount of urea as a measure of the activity of the kidney instead of considering it in connection with what the patient takes to eat.

On the whole the methods that seem to me to give the best information are the simplest and easiest methods, the time-honored ones of studying the color of the urine, the 24-hour quantity, and the specific gravity.

Discussion.

Dr. Welch.—Dr. Cabot, as usual, has presented to us an interesting and suggestive communication. He says that he was surprised by Dr. Councilman's inference from a comparison of anatomical and clinical observations that there was often a striking lack of concordance between symptoms and diagnosis during life and the condition of the kidney found after death. It is perhaps worth noting that the converse is equally true. The pathologist cannot tell accurately from an examination of the kidneys what the function of these organs has been during life; he cannot construct clinical histories from post-mortem appearances.

The explanation of these discrepancies is not far to seek. We do not know upon what precise anatomical lesions urinary changes, especially albuminuria and the presence of casts, depend, notwithstanding much experimental work on the subject. There are, to be sure, many theories. Consider for a moment albuminuria. The primary difficulty is to explain the absence of albumin in the normal urine, for the urine is in part a transudate from the blood, and such transudates are usually albuminous. If we accept the common idea that albuminuria results from some disturbance in the conditions of the walls of the glomerular capillaries and in that of the glomerular epithelium, and consider that such disturbance may be of a subtle nature and that the investigation of these structures is difficult, we can understand that on the one hand there may be marked lesions of the kidney without albuminuria, and on the other hand albuminuria without easily demonstrable structural alterations of the kidney. Similar statements can be made regarding the occurrence of casts in the urine. All of this is well known, and has been discussed by Cohnheim and many others.

We are grateful to Dr. Cabot for presenting this subject. His views have evidently struck a welcoming note in the hearts of our students, to judge from their applause, and I trust that we may hear from their instructors in the subjects touched upon by Dr. Cabot.

Dr. Emerson.—I am now going over our hospital records concerning nephritis, and while I have not yet finished I am quite sure the results will be almost the same as those Dr. Cabot has reported this evening.

We agree with him heartily concerning the value of considerable of the quantitative work on the urine unless the food consumed is known. On one point, however, we beg to differ; the relative value of total albumin and the percentage of albumin. If careful albumin charts be kept it will be seen that the line of the total albumin means little, while the line of albumin per cent depends directly on the diet, the position of the patient, his temperature, etc., and we believe that a urine with a low per cent of albumin means a much better condition of the kidney than one with a high per cent, even though the former, due to the greater total amount of urine, contains a much greater total albumin than the latter, in which case but little urine was passed.

As regards the point which the speaker has emphasized so strongly, the uselessness of accurate work and the sufficiency of simple, quick, approximate methods, our position is the following: We teach accurate methods that the student may be able to use approximate ones. There are three ways of working: inaccurate, which are worse than none, since the results merely mislead; accurate, which we would all do if we had the time (I use the term accurate in the ordinary sense of the term, meaning thereby the best method we know, although we admit that even it leaves much to be desired); and approximate, which we believe can only be safely done by one well trained in the more accurate methods of which the approximate are usually abridgements. To illustrate, the third year class is now in the throes of blood work and the amount of practice involved to gain the standards of accuracy we require is very considerable. We believe that for the practitioner of medicine there is no better method of hæmoglobin estimation than the quick Tallquist scale, but only those can use that safely whose eye has been trained by more careful methods with controls. It is said of a certain famous clinician of Vienna that from the drop of blood on a handkerchief he can guess the hæmoglobin within one-half of one per cent. But how could he gain any such accuracy (undoubtedly exaggerated)? Only by long, patient experience with the Gowers, v. Fleishl, and especially the Miescher instruments. I believe that a trained worker can make a satisfactory blood count by counting one unit square (that is, one-sixteenth of the ruled millimeter surface), but were a student to try to do that the first time his result would be approximate indeed. We therefore insist on a great amount of practice with control counts until we are sure his technic is such as would justify a diminution in the number of units counted. Although I sympathize with the class just now I see no reason for lightening their burden and shall insist that the prescribed work be done.

DR. CABOT.—The attitude that it seems obvious I ought to take in regard to what Dr. Emerson says about the table of percentage albumin contained recalls to my mind a remark of Dr. Fitz, whom you all know. He had stated to the students one afternoon at his three o'clock lecture that in typhoid fever there was a constant leucocytosis. The matter was called to my attention and the next morning when I met him on his way to the wards I taxed him with it. He said, "I back down." That is my answer to Dr. Emerson.

Observations on Pericarditis with Effusion. DR. THAYER.

(See BULLETIN for May, 1904, page 149).

DISCUSSION.

DR. CABOT.—My experience has been very much like that of Dr. Thayer. Most of the taps of the pericardium I have seen have been dry taps. Most of the fruitful ones have been taps well outside the nipple line.

DR. COLE.—The second case reported was of very great interest to me, and the study of it during the short time we had the patient under observation and a study of the condition found at autopsy convinced me that we should be more radical in the treatment of such cases. Unfortunately, the patient was in a desperate condition on admission, and after inserting the needle twice, as Dr. Thayer has stated, I thought best to discontinue the attempt to obtain fluid for a short time at least. A couple of hours later I was making preparations to insert the needle in the axilla when the patient died. At autopsy the heart was found lying closely against the anterior chest-wall, so that in this case the usual situation advised for inserting the needle proved to be the worst possible one. In fact, at autopsy, on inserting a needle through the pericardium at this point practically no fluid could be obtained. However, we could have drawn off a considerable amount of the fluid either in the axilla or by inserting the needle in the back, as the pericardium was distended into a large pouch pushing up the lung and lying against the posterior chest-wall.

Considering the impunity with which the pericardium is freely opened by surgeons in pyo-pericardium or in injuries to the heart muscle, it is a question whether in such cases as this, instead of inserting a small needle, it would not be advisable to either insert a large trocar and through this insert a small soft rubber tube, as a small rubber catheter, or even to make a small incision through the pericardium and through this opening insert such a tube or catheter. This could be inserted as far as desired so as to pass around and below and behind the heart, and by means of an aspirator attached to the external end all the fluid could be withdrawn, even though it lay behind or outside the heart, as in this case.

There would thus be no danger of injury to the heart, and with careful technique there would be no danger of infection. After removal of the tube or trocar a stitch could be taken in the pericardium. I simply offer this as a suggestion, but I can see no objection to a trial being made in a suitable case.

January 4, 1904.

The meeting was called to order by the President, Dr. Futcher.

Effect of Altitude on Blood Corpuscles and Blood Plates. DR. G. T. KEMP.

The work of which I will give you an account this evening is that of an expedition organized from the graduate students of the University of Illinois, with which I am connected, and I want to say at once that this work was not done by a set of students just entering the University, but by experienced men. Each of the party had had at least one year's experience in special work with the instruments they used on the expedition.

I took the party from Champaign, Illinois, to Cripple Creek, Colorado, for two weeks and went from there to Pike's Peak for a stay of eight days, and then back home. We took the record of blood plates and corpuscles, first at Champaign, then at Cripple Creek and Pike's Peak and at home. Each one of the six of the party was in a thoroughly healthy condition.

Our daily routine work involved the following observations: Count of the red corpuscles, ratio of blood-plates to red corpuscles, determination of hæmoglobin, determination of specific gravity, count of the white corpuscles, examination of the blood under various conditions, with a $\frac{1}{12}$ oil immersion objective.

The blood was drawn from the finger by an ordinary spring lance and each one, standing by to take his observations, was supplied with the same drop of blood so that all the comparisons were accurate. The first thing to which I will draw your attention is this composite curve made up from observations on all six of the party. All followed very closely the same lines: we were thus dealing with a law and not an accident. The red curve represents the number of red corpuscles, while the ratio of blood-plates to red corpuscles is shown by the blue line.

Now as to the red corpuscles, it is an old story that they increase as we ascend to higher altitudes. That was discovered first by Paul Bert in animals kept under diminished atmospheric pressure, and has been corroborated over and over again. On the 11th of July we reached Cripple Creek and on that day our blood count was the same as for the two days prior. Two days later the number of red corpuscles had risen from 5,200,000 to 5,900,000. On the 2d of August it dropped unaccountably in five of us and I could find no cause for it except the possibility of some climatic change. The drop was only temporary. It is a short journey from Cripple Creek to Pike's Peak, but we found in that change from an altitude of 9400 feet to one of 14,200 feet that the corpuscles increased to about 6,000,000. On Pike's Peak we took records both morning and evening and we were astonished to find that the morning count ran from 600,000 to 900,000 higher than the afternoon count; that is the average of the six; in individual cases is was over 1,000,000.

Now let us consider the hæmoglobin curve. The first thing we found was that it rises and falls in a general way with the curve of the red corpuscles, but that it does not follow this absolutely. As we went to a higher altitude the hæmoglobin percentage increased on the first day before the red corpuscles had increased in number. With this point in mind we could actually predict, several times, an increase in the number of corpuscles from a rise in hæmoglobin percentage, and, in general, if you figure it out you will find that the hæmoglobin varies less than the corpuscles, and that when few red corpuscles are circulating they carry a larger percentage of hæmoglobin. While the number of corpuscles changed markedly between morning and afternoon counts the hæmoglobin varied much less. It is unreasonable to suppose that these red cells die between morning and afternoon, and I am quite prepared to believe that they are simply withdrawn from the circulation for a time; I am even prepared to believe that they are taken into the spleen for some purpose and that possibly they go there to shift their hæmoglobin. It is certainly a fact that when the smaller number of corpuscles are circulating the percentage of hæmoglobin is higher than when the reverse condition obtains.

Now as to the blood-plate ratio. At Champaign the figure was abnormally high. In the winter it ought to be low, from 1 : 7 to 1 : 15, but during the summer, the only time our party investigated it, we found it 1 : 24. Within 24 hours after arrival at Cripple Creek the curve fell enormously and then gradually from the 12th to the 27th of the month.

Please note that the curve represents the values of x in the equation. Plates : Reds : : i : x, therefore a *fall* in the curve represents a corresponding *increase* in the number of blood-plates.

The numerical changes in the blood-plates are far greater than in the red corpuscles, and the change in the ratio between the plates and corpuscles is of longer duration and far more regular. As we returned to Champaign the ratio fell again. So regular is this ratio that if you suppose you are treating a patient at a low altitude, and he is sent higher and falls in the hands of a man who does not possess a blood-counting apparatus, but is able to make a good observation with the microscope, he could count the corpuscles and platelets and obtain a fair index to the changes going on in the blood, from the ratio between the two. It seems that we have here a new index to the development of corpuscles at high altitudes. It might be said here that the leucocytes were not changed by the changes in altitude, either in number or kind.

Now I would like to say a few words about some observations we have made upon the plates in regard to their chemical nature which may throw some light upon the question as to what they are. I am not prepared to say what they are or what they do, but we have strong evidence in favor of the discarded view of Hayem, who claimed that the blood-plates were hæmatoblasts; that is, they made red corpuscles. He is the man who re-discovered the blood-plates and he has done a great deal of work upon the subject, but his claim that they contained hæmoglobin and were really young corpuscles has not been generally accepted. Three years ago I was in Switzerland and started to make some observations on my own blood on the Görner Grat. I had counted my red corpuscles and plates for several days in Paris, and went as directly as possible to the top of the mountain. I was surprised to find that my count in Paris, which was 4,800,000, had risen to over 6,000,000, but the rise in the blood-plates was twice as great; and yet not a sign of hæmoglobin could I find in any one of them. I looked for that very carefully too in this work at Cripple Creek, and we found that along about the 21st, ten days after our arrival, hæmoglobin was seen in the blood-plates. Prior to that the number had increased enormously but no trace of color had been found in them. Just before their number reached its highest point we found the hæmoglobin, and at the same time we found microcytes, but no hæmoglobin could be seen in them either. After the hæmoglobin was found in the platelets we repeatedly found connecting links between the platelets and the red cells. These were, as far as we could judge, identical with Hayem's "globules nains."

From other observations we had made, it appears that the red cells contain comparatively little nuclear matter, whereas the blood-plates are exceedingly rich in nucleo-proteids. This can easily be shown by fixing them on the slide, hardening in alcohol and digesting with artificial gastric juice. We also tried other tests, that of MacCallum and that of Fisher with the nuclear stains. The stains proved that in the specimens of blood-plates the nuclear matter was spread about in them as granular matter while the red cells did not so stain. It thus looks as if the blood-plates were related to the nuclear substances and that they are not derived from the stromata of the red corpuscles.

An account of our methods for numeration of the blood-plates may be found in American Journal of Physiology, Vol. V, 1901, p. iv. Dry preparations will not give accurate or even approximately accurate results.

Discussion.

Dr. Osler.—As one of the oldest students of the blood-plates it gratified me extremely to hear that one of them had ever been seen by so good an observer as Dr. Kemp in a state of hæmoglobinic redness. I have spent many weary hours over them, but I never caught one "blushing." It really is a point of a very great deal of interest, and that one so familiar with blood-plates as Dr. Kemp, one who has studied them so long, should have made this observation is of extreme value and I am only sorry that the distinguished French observer, Hayem, who wrote so learnedly about them as progenitors of the red cells, is not here to-night to hear the good word. It does not seem possible with our present knowledge to say what the blood-plates are or what they do.

DR. KEMP.—Gentlemen, I have searched with the same assiduity as Dr. Osler, for years, for some trace of hæmoglobin in the platelets and I have not only failed before to find it but I have written against and spoken against the theory; I believe, however, that when a man finds he has been wrong it is well for him to acknowledge it. We did not observe hæmoglobin in the plates until we had remained on the mountain ten days and probably if I had stayed that long in the Alps I should have succeeded there.

Dr. Welch made a point I should like to mention, namely, that no one should ever suppose that a consumptive was improving simply because the plates had increased in their ratio to the corpuscles. We had studied our conditions very carefully before starting on the trip, and the same would have to be the case with a patient under treatment. I believe the ratio will prove to be quite as good an index of improvement as a count of the red corpuscles.

Vaccine and Vaccination (Illustrated). DR. GEORGE DOCK, Ann Arbor, Mich.

(See BULLETIN for April, 1904, page 109.)

DISCUSSION.

DR. OSLER.—We have listened with a great deal of pleasure to Dr. Dock's remarks, no portion of which comes home to us more here and in all American schools than that regarding the systematic neglect of vaccination. I do not know that any of our schools demand a certificate of instruction in vaccination before graduation. Such certificates are universally demanded in English and German schools.

The question he has raised of government supervision is most important. It would probably be difficult to get national control, as it is rather a State matter, but the government at Washington might take hold of it through the Bureau of Animal Industry or the Marine Hospital Service and provide free a good vaccine, and thus swamp the private producers. The machinery is there and might well be used.

January 18, 1904.

The meeting was called to order by the President, Dr. Futcher.

Studies in Blood Pressure. DR. ERLANGER and MR. HOOKER.

After describing the method and apparatus, Dr. Erlanger gave the details of a case of cyclic albuminuria, with reference to arterial pressure. It was found that when the patient was lying down, the pressure was lowest; that it raised if he stood up, and fell again if he sat down. His albuminuria disappeared when the patient was sitting or lying down, but reappeared when he stood up. An increased pulse-rate pressure gave a diminution in the urine output, with an increase in the solids and the nitrogen.

This article will appear in full in Volume XII of the *Johns Hopkins Hospital Reports.*

DISCUSSION.

DR. HURD.—I know nothing about these functional albuminurias, but I am impressed with one point in connection with Dr. Erlanger's remarks. It has been noticed that in melancholia there is often great mental distress in the morning. Very often after an extremely comfortable night, and when the patient may have slept better than usual, the mental distress in the morning is more severe than in the latter part of the day. After the patient has arisen and gone about and has had muscular exercise he begins to brighten up and feels better, and usually in the evening is fairly comfortable. In looking at the figures presented as to the differences between standing and lying down you get an explanation of the distress of these patients in the morning. The output of solid substances has evidently been much greater during the night on account of their recumbent position, and the blood has thereby become more poisoned. Of course there may be some derangement of metabolism back of that in melancholia, but the contrast presented in the figures in the recumbent and sitting postures here given is very striking.

DR. CUSHING.—The society is to be congratulated on the privilege of listening to the report given us of this beautiful piece of work. I feel as if I had taken a mental gallop, and I do not feel as capable of discussing the subject as I should like to do or as I might if we had been given more of the work and seen a demonstration of the apparatus which has been instrumental in bringing about the results.

The result that has been obtained in the study of this case of albuminuria is not, of course, the least interesting part of the demonstration, and it is important from our side of the fence because it shows how useful the study of blood pressure may be made in the interpretation of certain obscure clinical phenomena. If we had an Erlanger to attach to each of our cases in the hospital to study the blood pressure we might progress much more rapidly than we have done.

DR. ERLANGER.—It is now generally believed that the maximum pressure is lower in the standing posture than in the recumbent. This results from the fact that most blood-pressure determinations have been made with instruments that give the maximum pressure only. Quite recently Potain, using such an instrument, has found that the maximum pressure may either rise or fall, the effect depending largely upon the previous condition of the subject. On the other hand Colombo, using the Mosso apparatus, found, as others have since his time, that the change from the recumbent to the standing posture is associated with a rise of pressure. Both of these observations are correct. For, as has been shown, the averages of the pressures indicate that the maximum pressure remains more or less constant but that the minimum pressure rises. This is, however, true of the general averages only. In an individual determination both pressures may either rise or fall, but they invariably approach one another. Therefore, the only constant feature is a diminution of the pulse pressure.

DR. FUTCHER.—I have had an opportunity during the last week to make a few observations on the urine and blood pressure in a case of albuminuria for Dr. Osler, and there are some points I would like to get information upon, and I hope Dr. Erlanger will be able to give it to me. The case brings out one feature of importance and that is the apparent necessity of taking minimum blood pressures in cases of this kind. The determinations I made were with the Riva-Rocci instrument, which takes the maximum pressures only. The patient was a young girl about 14 with the history of transient attacks of albuminuria. A specimen of urine taken on Wednesday morning showed a specific gravity of 1.014, a trace of albumin and no casts. The urine was free from casts throughout the period of observation. Wednesday afternoon the patient came in for a blood-pressure determination, and after she had been on her feet all day the urine that evening showed about 1-20 per cent of albumin. On Thursday the patient was on her feet most of the day and had some of the nitrogenous foods cut off. That morning the urine contained no albumin whatever, but in the evening there was again approximately the same percentage as before noted. On Friday the patient remained in bed, and morning and evening specimens of urine were examined; the first contained absolutely no albumin and the evening specimen the merest trace. The blood pressure at 5.30 P. M. on Friday was 112, while on Wednesday afternoon it was 150. I had expected that there would be no albumin in the Friday evening specimen, but I found the patient sitting up in bed. I would like to ask whether, in these cases of orthostatic albuminuria, the assumption of the sitting posture in bed will cause the albumin to persist in the urine or whether it is necessary for the patient to be on his feet.

Mental Symptoms Connected with Distinct Visceral Changes.

Dr. Cary Gamble.

(To appear in a future number of the Bulletin.)

The Periureteral Arterial Plexus and the Importance of its Preservation in the Operations for Cancer of the Uterus.

Dr. Sampson.

(See Bulletin for March, 1904, page 72.)

DISCUSSION.

Dr. Hurd.—I desire to call attention to the great value of the studies which Dr. Sampson is making in this branch of surgery. We have had very few papers presented here which have shown more originality of thought and more care in working out details than the several papers presented by Dr. Sampson this winter. I wish to congratulate him on his successful work.

February 1, 1904.

The meeting was called to order by the President, Dr. Futcher.

Presentation of a Case of Scleroderma. Dr. E. K. Cullen.

The patient, a young girl 14 years of age, has a sclerodermatous patch over the posterior aspect of the left shoulder. The lesion dates from an injury inflicted twenty-five months before, the patient having struck the affected area against a dresser. The general health has been excellent and the family and personal history are negative.

The area of scleroderma extends from the tip of the acromion process to within a few millimeters of the base of the scapular spine, upwards to the anterior border of the trapezius and downwards to one finger's breadth below the spine of the scapula. The patch is slightly irregular in outline. The center presents an atrophic and ivory white appearance. At points, particularly about the outer edge, are fine, glistening scales, while scattered throughout are little irregular areas showing a light brownish pigmentation. The skin, which over the entire area feels hard and thickened, is pinched up with difficulty, but at only one point near the base of the scapular spine is there any pain experienced during this procedure. The border is thin, undulating, slightly elevated, and appears to be formed by a minute plexus of vessels. In its outer and upper parts the border is more prominently defined than in its lower and inner parts where it shades off gradually into the normal skin.

Treatment.—On August 8, the date of admission to the dispensary, treatment by thyroid extract was commenced. The compressed thyroid tablets were used in the following dosage:

Grs. iiss once a day for two days.
Grs. iiss twice a day for two days.
Grs. iiss three times a day for two days.

The thyroid treatment has been continued for the past five and a half months, with only a small intermission of a week, on two occasions. No ill effects have been observed and the patient has continued to increase in weight. The skin has become much softer and is gradually assuming the normal consistence and color.

DISCUSSION.

Dr. Osler.—The case is an unusually interesting one, particularly from the standpoint of the patient's condition at present. It is very unusual to see so rapid improvement. Of course the local scleroderma is a more hopeful condition than the generalized form. A great many cases recover completely and only a few instances progress to the diffuse form. There is no essential difference between the conditions, although most text-books consider them separately. I have had under observation 18 cases of scleroderma (8 of which I have reported), only two of which were of the local type. Of these, one has been very much helped by the thyroid extract; she has been under my observation three or four years, and while not cured, the skin has become soft, all the induration is gone and there only remains the extensive pigmentation.

Of course in the general features the diffuse and the localized scleroderma are quite distinct. I do not know that there is any disease that brings to the patient so much distress and suffering as does the diffuse type. One of our recent cases was literally encased in a shirt of Nessus. He was unable to move his arms or legs, his entire body was as stiff as a frozen pig.

There is a group of cases intermediate between the localized and diffuse form. A young man in a neighboring town has a condition of the left arm like Gowers described as local panatrophy, in which the process has involved skin, muscles and bones.

In two of our cases of the diffuse type it may be said that the disease has been arrested. One of them has been under observation for ten years, and while his hands are distorted he is able to go about in fairly good health. In another of the cases which I reported, the patient had a most extensive scleroderma of the hands and legs. I hear through Dr. Thayer that the patient is wonderfully better in spite of an ardent devotion to Bacchus. He says he could not live without thyroid extract.

A Case of Myelogenous Leukaemia. (With exhibition of the patient.) Drs. C. E. Simon and D. G. J. Campbell.

The patient is a woman, æt. 35, with nothing of moment in her family or personal history until about two years ago (1901). She then noticed a bulging from below the ribs on the left side, which gradually increased and extended to the left groin. On first examination, at the City Hospital (March, 1903), the growth was recognized as the enormously enlarged spleen. Blood examination at that time showed a typical picture of a myelogenous leukæmia. Within a month the leucocytes fell from 350,000 to 4000 and have since not risen beyond normal values. The relative percentages, barring a persistent increase of the mast cells, became practically normal, and ever since May, 1903, the spleen has been barely palpable on deep inspiration. Fowler's solution was used in large doses.

(At the time of writing, April, 1904, the patient's condition remains unchanged. The case is thus the only one on record in which both the splenomegaly and myelæmia have disappeared and improvement has persisted uninterruptedly for a year.)

The full report of the case with a review of the literature will appear in the *Medical News*.

Discussion.

Dr. Osler.—We have had three cases here in which the leucocytes have disappeared entirely in leukæmia. In the case Dr. Campbell referred to, reported by Dr. McCrae, the leucocytes disappeared entirely and he left the hospital apparently well, though, if I remember rightly, he had some blood changes left that were suspicious. As Dr. Campbell remarked, his subsequent history was not clear. He died in California.

In the other two cases the spleen did not disappear, but remained large while the leucocytes fell to normal. One of those cases is reported in the American Text-book of Medicine, in the article on leukæmia, and the other case some of you have seen during the year in the hospital wards. Those are the only three instances in my recollection in which I have seen the leucocytes fall to normal and remain so.

The second point of interest in this case is the length of time during which he has taken arsenic and in such large doses. I would be inclined to attribute the good effects secured in this case to the arsenic and think there is no question but that in the full and complete treatment with it we do see such marked improvements. It is just these cases that stand the long-continued treatment with arsenic and have a chance to improve.

Remarks on Pneumonia in Diabetes Mellitus. Dr. Futcher.

Discussion.

Dr. Osler.—I think one of the interesting points about this case is the acuteness of its course, by far the most acute case we have had in the hospital in an adult. It does occasionally happen in the adult that the disease runs a very acute course, and I saw one case in which from start to finish it was only three weeks. It is often a matter of surprise in making a routine examination in diabetes to find extensive pulmonary lesions, and it is often noticed that without cough or fever a patient may have progressive wasting, and that may alone be the feature indicative of progressive disease in the lung.

Dr. Frank R. Smith.—About three years ago I was called to see a man in a comatose condition and his doctor told me that for two years there had been a large amount of sugar in his urine. He said the case was undoubtedly one of diabetic coma, and opinion with which I at first fully agreed. We examined him carefully, however, and found he was suffering from pneumonia. He got over the pneumonia, the sugar disappeared from the urine, and nine months later it was still absent. I do not know his ultimate condition.

We sometimes accidentally discover diabetes that has been going on for a long time. About a month ago a man came into my office complaining only of a slight sore throat, but while there asked if he might pass his urine. He passed about a pint and a half of clear urine with a specific gravity of 1.035 containing a large amount of sugar. I had inquired about thirst and hunger before making the examination, and he said he was never thirsty, although he might have had a habit of drinking a good deal of water. A case of this kind might have been going on for many months, and I mention it to show how difficult it often is to establish the exact date of the onset of the disease.

Loco weed Disease of Sheep. Dr. Marshall.

Dr. Marshall took part in an expedition sent out by the United States Department of Agriculture during the autumn of 1903 to investigate the loco weed disease in Montana.

Loco disease is a disease affecting horses and sheep and occasionally cattle and goats. The victims are supposed to be poisoned by the loco weed, for which they form a preference, eating the weed to the exclusion of other diet. *Astragalus mollissimus* and *Aragallus spicatus* are the two commonest loco weeds. Accessory factors are considered of great importance by the ranchers. (1) Age. Almost without exception the disease appears before the end of the second year. (2) Insufficient food is frequently the important predisposing factor. (3) Insufficient supply of water is equally important. Lack of salt is considered by many ranchers to be the most important of all predisposing factors. Many think that if animals are well supplied with salt they will escape loco disease altogether. (5) All ranchers agree that *healthy animals never acquire loco weed disease. A lowered state of vitality is always a precursor of loco weed disease.*

This malady has been known for 50 years or more. It was first recognized in Mexico or Texas. It gradually spread north and reached Montana about ten or twelve years ago. It is found from western Kansas to California on the prairies and foot-hills at an elevation of about 4000 to 6000 or 7000 feet.

The incidence varies from year to year. In affected regions from 10 to 25 per cent of the annual increase die from this cause. The disease spreads in epidemic manner, appearing first as a rule not sooner than 10 or 15 years after a region has been settled. The disease appears in early spring and late autumn. The symptoms come on insidiously. Tame, well-broken animals become unmanageable. Defective vision, mental and nervous symptoms develop. Ultimately the victim emaciates, eats nothing except loco weed, in the search for which he spends his time, and after a long period, usually months or years, dies from weakness or intercurrent disease.

The only "locoed" animals that could be found on the recent expedition were sheep. About 1000 "locoed" sheep were seen on different ranches, from which number reliable and experienced rangers selected a few of the sickest and most typical "locoed" animals for study. Experiments indicated that these "locoed" sheep did not prefer a diet of loco weed to one of grass or alfalfa. Feeding experiments caused no new symptoms. The symptoms were not alike in all cases. All of the cases were in lambs or yearlings; all were undersized, emaciated and weak, with stilted gait, drooping head and dull eyes. Sensation, sight, hearing, etc., appeared normal. Many of the "locoes" showed defects in the incisor teeth. In one or two flocks large numbers of animals were afflicted with bronchitis, conjunctivitis, etc. Usually the fleece was rough. One animal had a muscular tremor. Autopsies were held upon the freshly killed animals. Tissues were fixed in Zenker's fluid and examined microscopically. No anatomical evidence was found of injury produced by the loco weed. In every case the sheep were infected with from one to five parasites. The parasites found were: (1) *Thysanosoma actinioides* or "fringed tapeworm," obstructing the bile ducts in 9 cases; (2) *Haemonchus sp.* in the 4th stomach in four cases. This worm which appears to be a new species similar to the *Strongylus contortus,* is being worked up by the United States Bureau of Animal Industry; (3) *Metastrongylus filaria* in the bronchioles in 5 cases; (4) *Sarcocystis tenella* in the muscles in 7 cases; (5) *Cysticercus tenuicollis* adherent in peritoneal cavity in 5 cases; in one of these cases a cyst was also found free in the pericardium. Dr. Chas. W. Stiles kindly identified the worms for Dr. Marshall.

In addition, an extradural basilar abscess was found in the animal which exhibited muscle tremor. These results were obtained from 11 complete autopsies. Many other partial autopsies gave the same results. The "fringed tapeworm" produced a dilatation of the bile ducts and often of the pancreatic ducts and there was strong evidence that it also produced occasionally an obstructive biliary hepatitis.

From its resemblance to *S. contortus* it seems probable that the Haemonchus is a dangerous enemy to the sheep. Its exact action could not be determined, but it evidently is less virulent than the *S. contortus.*

The *Metastrongylus filaria* was found in all of the cases with bronchitis, conjunctivitis, etc. The *Sarcocystis tenella* was found in every case in which the tissues were studied microscopically. Apparently it is harmless, as is the *Cysticercus tenuicollis.*

After a discussion of his findings and of the data obtained from the literature and from the ranchmen, Dr. Marshall concluded that the evidence indicates that there is no true loco disease of sheep produced from eating the weed, but that so-called "locoed" animals suffer from bad feeding, insufficient care, and a variety of other diseases, the most important of which are the parasitic diseases.

NOTES ON NEW BOOKS.

The Lymphatics. General Anatomy of the Lymphatics. By G. DELAMERE. Special Study of the Lymphatics in Different Parts of the Body. By P. POIRIER and B. CUNÉO. Authorized English translation. Translated and edited by CECIL H. LEAF, M. A., M. B., F. R. S. (Eng.), Assistant Surgeon to the Cancer Hospital, etc. With 117 illustrations and diagrams. (*Chicago: W. T. Keener & Co., 90 Wabash Ave., 1904.*)

The book represents the results of the labors of Prof. Poirier and his pupils brought up evidently to 1902. The first part deals with the general conceptions of the anatomy of the lymphatic system and with the physical and chemical nature of the lymph. Following this is a rather minute consideration of the morphological elements of the blood and lymph in which Ehrlich's views receive due discussion and the classification of cells adopted is essentially his. Morphology, physical and chemical properties, biological characters and modes of development and reproduction of these cells are entered into in detail. All of this is characterized by great breadth of view and fairness of judgment. We may, however, criticize certain statements as premature, for example on p. 35, it is said that, "It is proved that a leucocyte can become a connective tissue cell and it is at least very probable that a connective tissue cell can become a white cell." Again the objections to the use of the term myelocyte on pp. 36-37 seem insufficiently supported. The descriptions of the various types of cells are excellent.

Then follows a historical sketch of the development of our knowledge of the anatomy of the lymphatic vessels up to the work of v. Recklinghausen and Ranvier. Throughout this chapter the view is held that there are completely closed vessels lined with endothelium and that there is as good evidence for the view of v. Recklinghausen as to their free communication with the tissue. Ranvier's conception of the lymphatic system as a gland emptying into the veins is given, but at the time the book appeared the authors had evidently not seen Dr. Sabin's classical description of the development of this system.

Some interest attaches to the discussion of the distribution of lymphatics especially in the statement that it is still very uncertain whether or not any lymphatics exist in the brain and meninges.

A minute account of the anatomy, development and physiology of the lymph glands follows, characterized by the same breadth of view and abundance of detail. The second part of the book, and by far the larger part, is devoted to the study of the regional anatomy of the lymphatic system.

The literature references which are arranged in chronological order are very complete and since the translation is very good the book forms an excellent book for reference, even if one can refrain from reading it through.

A Text-book of Legal Medicine and Toxicology. Edited by Frederick Peterson, M. D., President of the New York State Commission in Lunacy; Clinical Professor of Psychiatry, Columbia University, New York; General Consultant to the Craig Colony for Epileptics, Sonyea, New York, and Walter S. Haines, M. D., Professor of Chemistry, Pharmacy and Toxicology in the Rush Medical College, Chicago; Professorial Lecturer on Toxicology in the University of Chicago. Volume II. *(Philadelphia, New York and London: W. B. Saunders & Co., 1904.* 825 pp.)

The completion of this excellent work will be welcomed by teachers of this subject as well as by physicians and lawyers who find it necessary to consult a fairly comprehensive work on forensic medicine.

Part 1 of volume II is devoted to the subjects relating to sex, insanity and malpractice and contains a brief but well written chapter on the medico legal relations of the Röntgen rays including the interpretation of skiagraphs and a discussion of the X-ray burns. Part 2 is devoted to toxicology and this portion is exceptionally good. Many references to the original sources of the material are given. The various subjects are written by eminent specialists. Thus it might be mentioned that the chapter on the alkaloid poisons is written by Prescott. Vaughn contributes a chapter on the ptomains and other bacterial products in their relation to toxicology.

Taken altogether the work is a most satisfactory one and deserves to be largely used. A. S. L.

Blood Immunity and Blood Relationship. A demonstration of certain blood relationships amongst animals by means of the precipitin test for blood. By George H. F. Nuttall, M. A., M. D., Ph. D., University Lecturer in Bacteriology and Preventive Medicine, Cambridge; including Original Researches by G. S. Graham-Smith, M. A., M. B., D. P. H., Cambridge; T. S. P. Strangeways, M. A., M. R. C. S. (*Cambridge: At the University Press, 1904.*)

This volume of 400 pages summarizes the results of the original researches of Dr. Nuttall upon the subject of the *precipitin reaction*, portions of which have already been published either alone or in connection with his two co-workers, Graham-Smith and Strangeways, in various numbers of the Journal of Hygiene, British Medical Journal and other periodicals. It aims to put in concise form, ready for accurate reference, not only the observations made in Cambridge, but also those of other workers who have busied themselves along similar lines. This publication is particularly interesting, because primarily Nuttall was, early in the days of the Pathological Laboratory of the Johns Hopkins University, a most valued assistant in bacteriology and hygiene and while here established a reputation for enthusiastic painstaking and accurate investigations, his work being noted both for the originality of his ideas and for the original methods by which they were put in execution. Secondarily it may be mentioned that Dr. Nuttall's early studies of the bactericidal properties of normal blood serum, conducted while working for his doctor's degree in Flügge's laboratory in Breslau, were the starting point for that enormous development of the study of the blood sera of normal and immunized animals, and in a certain sense, of the development of the humeral theory of immunity, even though Nuttall's work was antedated by some isolated observations of others, and in spite of the fact that Nuttall has not received merited recognition for this work in Germany itself.

The main thesis of Nuttall's present publication is the claim that by means of the *precipitin reaction* seen on mixing the blood serum of an animal treated with the blood serum of an alien species, with portions of the original serum employed, the *phylogenetic relationship* of various members of the animal kingdom may be determined with almost absolute accuracy, with far greater accuracy indeed than the study of morphological or functional characters has thus far been able to carry us. For the proper understanding of the main portion of the book, including extensive tables giving records of over 16,000 different tests, the first third of the book at least is given up to an accurate analysis of the literature of the subject of *precipitins* and of those closely allied subjects of *agglutination* and *haemolysis*, including here a brief consideration of Ehrlich's theories.

Quite aside from the main purpose of the book the preliminary portion is invaluable, not only because it is the first extensive literary study of precipitins, but because it is invested with the accuracy and completeness of Nuttall's usual methods. The experiments of nearly every observer in this field are cited, their methods criticised, their results analyzed, and a careful opinion passed upon the value of their work. Extensive consideration is given to the various factors which may influence the *precipitin reaction*, while the effects of chemicals, heat, cold, and putrefaction are all made the subject of personal investigation by the author and his associates.

The methods of obtaining blood sera, the manner of immunization of animals, and the technique of the reaction itself are all described with painstaking exactness.

The principal part of the book of course is taken up with the consideration of Nuttall's own experiments. During the progress of his investigations he has prepared anti-sera for a very large number of animal species, including man, chimpanzee, ourang, monkey, hedgehog, cat, hyena, dog, seal, pig, llama, hog-deer, Mexican deer, antelope, sheep, ox, horse, wallaby, among the mammalia; fowl and ostrich, among the aves; turtle and alligator, among reptilia; frog among the amphibia, and lobster among the crustacea. With the sera thus obtained Nuttall has tested the blood of nearly every known species of domesticated or wild animals, specimens being sent him from nearly every quarter of the globe. These specimens were obtained in the field by collectors, dried on strips of filter paper, sealed up in cases, and sent to Cambridge, where they were carefully catalogued and preserved.

Each anti-serum was now tested with the serum employed in immunizing the animals, an homologous serum, and with sera from various other species, heterologous sera. The strength of the reaction obtained with the homologous serum, as measured by the amount of the *precipitum* was now carefully compared with that seen with the heterologus sera. Thus anti-human serum was tested with human serum, with various fluids from the human body, ascitic and pleuritic effusions and urine, with serum from other primates including chimpanzee, gorilla, mandrill, guinea baboon, monkey, lemur, and from a number of less closely related species. In the same way anti-monkey serum was tested with a similar series of bloods, while the sera obtained from the employment of other orders, were tested against the blood of members of that order. Thus anti-horse serum was tested with blood from the equidæ especially, and from as many other closely related families as possible. It is apparent at once what an enormous number of observations would result from faithful adherence to this system, over a relatively long period of time.

As a result of several thousand reactions Nuttall concludes that the blood serum of an immunized animal *always* gives an abundant precipitum with that from the species employed for immunization, but gives as well a similar but quite positive reaction with the blood sera of species closely related zoologically. The latter reaction Nuttall would term the *mammalian reaction.*

The conclusions derived from these reactions and the relationships suggested by their application to such a large number of species afford the morphologist a most interesting theme for speculation. A few examples of the relationships indicated must suffice.

Anti-human serum reacts most markedly with the serum of man, but gives definite reactions with the blood serum of the simiidæ and the cercopithecidæ, although little or no reactions develop with the serum of the lemuridæ. Anti-chimpanzee serum reacts markedly with the blood of the homidæ and the simiidæ not at all with that of the lemuridæ, partially with that of the cercopithecidæ.

Anti-ourang serum reacts most markedly with the blood of the simiidæ and the cercopithecidæ, partially with that of the homidæ. Anti-monkey serum reacts best with the serum from the cercopithecidæ, less with that of the homidæ, not at all with that of the lemuridæ. From these and other observations Nuttall concludes that "if we accept the degree of blood reaction as an index of blood relationship within the anthropoidea then we find that the Old World apes are more closely allied to man than are the New World apes, and this is exactly in accordance with the opinion expressed by Darwin."

Again the anti-sera for hyenidæ give positive reactions for the homologous blood of hyenas and for the closely allied blood of cats, while the anti-sera for cats gives positive reactions not only for cat's serum but for that of the hyenidæ. Other sera were negative and one is thus led by the precipitin test alone to conclude that hyenas and cats are closely related genetically.

Similarly anti-reindeer serum reacts with reindeer serum, with serum from other cervidæ and with the closely related bovidæ, not with the serum from other mammals. Anti-sheep serum reacts most markedly with sheep's blood and the blood of the cervidæ, partially with the blood of the suidæ, not at all with other mammalian bloods.

Anti-pig serum, however, while giving most marked reactions with the blood of the suidæ also reacts abundantly with the blood of the cetacea, an unexpected result confirming the hitherto expressed opinion of Flower and Lydekker that the cetacea are more closely related to the ungulata than to the carnivora, and that "the old popular idea which affixed the name of sea hog to the porpoise contains a larger element of truth than the speculations of many accomplished zoologists of modern times."

It may be noted in passing that Nuttall's results with anti-human serum and with anti-monkey serum absolutely confirm the experiments of Wassermann and Uhlenhuth, whose observations, however, were conducted upon a considerably smaller number of species.

Finally not only are the reactions carefully estimated qualitatively but by means of a specially designed apparatus for measuring the quantity of the precipita obtained from the mixtures of various sera, Nuttall and Strangeways have made a large number of *quantitative* determinations of the reactions studied previously *qualitatively*, the former series of observations confirming in every particular the latter.

The last section of the book is in many respects the most interesting. Here Nuttall considers the precipitin test in its application to legal medicine in the identification of blood stains, especially in the identification of human blood by means of anti-human serum. He first considers in detail Wassermann's and Uhlenhuth's experiments bearing upon this point as well as his own previous communications upon the subject, and analyzes the many factors which may have any bearing upon the carrying out of the blood reaction in its application to forensic medicine, such as the action of chemical substances, rust, dyestuffs and other materials upon blood tending to vitiate its properties to such an extent that it may fail to react with its peculiar serum, as well as the presence in suspected material of substances which may give reactions simulating the precipitin reaction. In this connection he quotes a number of experiments of Graham-Smith and Senger, upon blood stained weapons and fabrics obtained from Scotland Yard, in all of which, despite the great age of some of them, as much as 25-30 years, a positive reaction was obtained with anti-human serum, and no reaction with anti-ox serum. Special observations were made to determine the effect of drying blood upon metal, organic materials, leather, of mixing it with lime, mortar and earth, only one of the latter substances, lime, being shown to actually destroy the blood when brought in contact with it. With no other material was human blood so affected that it did not give a positive reaction with anti-human serum.

The general conclusions of the book are summarized into two final pages.

The entire volume is filled with most interesting information not only in regard to the work and ideas of others, but in regard to the results actually obtained in Cambridge. Many of the tables presented seem at first sight difficult to understand, but after a certain amount of study and close observation of the various symbols utilized in preparing the tables, they become quite explicable. When one considers moreover the vast number of reactions given one realizes that some definite system of recording the strength of the reactions had to be employed.

There is but one adverse criticism which can be made and that is applicable to all who work upon the complex problem of immunity. There is too great a tendency to explain the occasional occurrence of anomalous reactions, especially if somewhat unexpected, by errors in the collection of the samples of sera. While it is perfectly possible that errors may have arisen, such as the occasional interchange of samples and labels, or the rubbing of one blood against another in the process of drying, in view of such an enormous number of positive results testifying to the care with which the specimens were collected, it is hardly fair to claim that when a few sera fail to give the desired reaction, some mistake must have been made in collecting them. While unexplainable and unforseen reactions do mitigate to a certain extent the absolute or relative specificity of the precipitin reaction, no one who has done any piece of investigation with immune sera will fail to admit that occasionally reactions develop which are absolutely out of keeping with any knowledge we now possess in regard to these very complex and intricate phenomena. In spite of this tendency, this book of Dr. Nuttall's upon "Blood Immunity and Blood Relationship" is not only the best publication upon the entire subject of precipitins, now extant, but contains such a mass of new material, new facts, and new conclusions, that it substantiates the author's own claim that "in presenting the results given in this book he is safe in saying that they constitute the first scientific demonstration on general lines of the specificity or relative specificity of precipitins."

The book is dedicated to Ehrlich and Metschnikow. W. W. FORD.

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THE BIOGRAPHY OF STEPHEN HALES, D. D., F. R. S.[1]

By Percy M. Dawson, M. D.,
Associate Professor of Physiology, Johns Hopkins University.

Just as the name of William Harvey stands foremost in that chapter of physiology which deals with the circulation, so does the name of Stephen Hales begin the sub-chapter on hæmodynamics.

In this sub-chapter the first important conception to be grasped by the student is that of the blood pressure, and the first experiment is designed to demonstrate its existence and to estimate its amount. This experiment is familiar to us all. It consists in connecting the femoral artery of a dog to a long glass tube. Into this tube the blood mounts up and up to a height of five or six feet and then oscillates up or down with each contraction or relaxation of the heart. Such a tube, as the student already knows, is called a manometer, and he is then told that this particular form of manometer, so simple in principle and construction, is called the "Hales manometer" after its inventor, a certain Dr. Hales. Thus every student of physiology becomes acquainted with the name of Hales, but to most of us it is a name and nothing more.

Stephen Hales was born in 1677. His grandfather, Sir Robert Hales, of Beckesbourn in Kent, was made baronet by Charles II. Sir Robert's eldest son, Thomas, married Mary, the daughter and heiress of Richard Wood. They had many children, and Stephen was their sixth son.

Of Stephen's boyhood there is nothing known. In his nineteenth year he was sent to Cambridge and was entered a pensioner of Corpus Christi College under the tuition of Mr. Moss, the future dean of Ely. Having taken the degree of Bachelor of Arts, he was pre-elected into a fellowship into which he was admitted in the following year. In the same year (1703) he obtained his degree of Master of Arts. Some time afterwards he entered into orders and became a Bachelor of Divinity in 1711. During his residence in the college, a period of about twelve years (1696-1708 or 1709), he applied himself with great zeal to the study of natural and experimental philosophy.

In William Stukeley,[2] afterwards M. D., F. R. S., who came in 1704 to live in Corpus Christi College, Hales seems to have found a very congenial companion, though Stukeley was the younger by ten years. Together the two used to ramble over Gogmagog Hills and the bogs of Cherry-Hunt-Moor to gather simples. One carried in his pocket Ray's Catalogue of Plants, to which Stukeley, who was a ready draughtsman, added a map of the country to guide them in their walks. Sometimes they collected fossils from the gravel and chalk pits and sometimes hunted butterflies, having contrived an instrument for taking them. The two friends also studied anatomy together, dissecting frogs, dogs and other animals; while Hales devised an ingenious method of obtaining a preparation of the lungs in lead. They moreover studied chemistry and "repeated many of Mr. Boyle's experiments" and prepared various substances, "some of use, some of curiosity."

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[1] Read before the Johns Hopkins Hospital Historical Club, April 20, 1903.

[2] William Stukeley, 1687-1765. In his undergraduate days he "went," he says, "frequently asimpling, and began to steal dogs

At this time Vigani,[3] of Verona, the first professor of chemistry at Cambridge, was lecturing at Queen's College Cloysters, and thither Hales and Stukeley used to repair, and were also witnesses of the chemical operations which Vigani was accustomed to perform in a room in Trinity College which had formerly been the laboratory of Sir Isaac Newton. Hales was also a student of astronomy and constructed a brass machine for demonstrating the movements of the planets, and of this Stukeley made a sketch.

About 1710 Hales was made perpetual curate of Teddington. He afterwards accepted the living of Porlock, in Somerset, vacating his fellowship in so doing, but this living he soon exchanged for that of Farringdon, in Hants. Teddington he made his home, though he appears to have occasionally resided in Farrington.[4]

The date of his marriage seems to be uncertain. His wife was Mary, daughter and heiress of Dr. Newce, rector of Halisham. In 1721 Mary died,[5] leaving no children. Hales never married again.

In 1718 Hales was elected Fellow of the Royal Society and became a member of the council of that body in 1727. In 1732 he was appointed one of the trustees of the newly-founded colony of Georgia.[6] In 1733 the University of Oxford conferred upon him the honorary degree of D. D., which was the more significant in that Hales had pursued all his studies at Cambridge In 1739 he received the Copley medal. In 1750, on the death of Frederick, Prince of Wales, he was appointed, without his solicitation or even knowledge, clerk of the closet and almoner of Her Royal Highness the Princess Dowager. In 1753 he became one of the eight foreign members of the French Academy in the place left vacant by the death of Sir Hans Sloane, president of the Royal Society.[7]

The work and writings of Hales embrace a very broad field, which includes chemistry, botany, physiology, medicine and public hygiene, not to mention sermons and temperance tracts. In 1719 he reported before the Royal Society some experiments which he had lately made on the effect of the sun's warmth in raising the sap in trees. This procured him the thanks of the Society, which also requested him to continue his research. "With this request," writes the biographer,[8] "which was like the charge given by Pharaoh's daughter to the mother of Moses, to take care of her son, Hales complied with great pleasure, and on the 14th of June, 1725, he exhibited a treatise in which he gave an account of his progress." At the request of the Society this treatise was published an appeared in 1727 under the following title: "Vegetable Staticks; or, an account of some statical Experiments on the Sap in Vegetables: being an Essay towards a Natural History of Vegetation; also a Specimen of an Attempt to analyse the Air by a great Variety of chemio-statical Experiments, which were read at several Meetings of the Royal Society." The "Vegetable Staticks" was so well received that a second edition was published in 1731. In the preface of this edition the author promised to add a second volume, and in 1733 he published his second famous work, entitled "Statical Essays: containing Hæmostaticks, or an Account of some Hydraulick and Hydrostatical Experiments made on the Blood and Blood-Vessels of Animals; also an Account of some Experiments on Stones in the Kidney and Bladder; with an Enquiry into the Nature of these anomalous concretions. To which is added an Appendix containing Observations & Experiments relating to several Subjects in the first Volume." These two books were again edited under the title, "Statical Essays, Vols. I & II."

Through the "Statical Essays" Hales came to have an international reputation, for not only was the first volume translated into French by Buffon, and the second into the same language by Boissier de Sauvages (1744), but before long there appeared German and Italian translations.[9]

If one were required to state the essential and distinguish-

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and dissect them" and once when at home, he "made a handsome sceleton" of an aged cat. Hales and Dr. J. Gray of Canterbury, were his botanical associates and he made large additions to Ray's *Catalogus Plantarum circa Cantabrigiam.*—D. N. B.

[3] John Francis Vigani, 1650?-1712, born in Verona; probably came to England about 1682, to Cambridge about 1683, where he gave private lessons in chemistry and pharmacy. In 1703 a grace was passed by the senate for "investing with the title of professor of chemistry John Francis Vigani, a native of Verona, who has taught chemistry with reputation for twenty years previously."—D. N. B.

[4] Letter preserved in the Library of the Royal Society, F. D.

[5] See L. L., III, 507.

[6] In 1734, Hales published a sermon which he had delivered at St. Brides, before the rest of the trustees of the colony, his text being Gal. VI, 2.

[7] "*Stephen Hales*, D. D., is elected member of the Royal Academy of Sciences at *Paris*, in the room of Sir *Hans Sloane*, Bart. Deceased." G. M., Feb., 1757, XXIII, 103.

[8] Peter Collinson, 1694-1768, F. R. S., 1728; naturalist, antiquary, and merchant; Quaker.

[9] These works contained copious notes by the translators and to the volume on Hæmostatics two memoirs by de Sauvage had been added one on inflammation and one on fevers. The two volumes were re-edited in 1779 as one book. In 1748 the two French works were translated bodily (memoirs, notes and all) into German. In 1750, M. A. Ardinghelli published her translation, Emastatica, in Naples; the text was translated from the English; the notes from the French of de Sauvage.

ing characteristics of these essays, the unhesitating reply would be that the work which they describe is quantitative. In everything that Hales did, one sees this constant effort to be exact. Qualitative results were never sufficient; Hales must needs weigh and measure everything, and every phenomenon must be expressed numerically so as to serve as the basis of calculations and thus lead to new discoveries.

It will be remembered that Hales studied chemistry under Vigani and that Vigani was the first professor of chemistry at Cambridge. In fact, Hales' life fell very early in the history of scientific chemistry, in that period when experimentation, though often suggestive, is usually indefinite and always incomplete.[10] Hales made a careful study of gases, or, as he called them, "air." To him air was an element which entered into the composition of a surprising number of substances, and so he studied the generation and absorption of "air" during distillation, fermentation and many other chemical processes. In his experiments he must have prepared hydrogen, oxygen, hydrochloric acid, carbon dioxide and ammonia, and though they were all "air" to him, he introduced some important improvements in the way of chemical apparatus and manipulations, and was perhaps the first chemist to employ quantitative methods.[11]

With respect to the purely botanical part of the "Statical Essays," suffice it to refer to a statement of Sachs. This well-known botanist writes that in the revival of plant physiology which took place in the eighteenth century, the work of Hales was the most original and most important contribution.[12] It was in honor of Hales that John Ellis, the "bright star in Natural History," as Linnaeus has called him,[13] named a newly discovered genus of plants *Halesia*.[14]

The contributions of Hales to animal physiology are many and important. His experiments in this field are described partly in the first volume of the Essays, but chiefly in that section in the second volume which is devoted to hæmodynamics A discussion of this part of Hales' work will, however, be reserved for another communication.[15]

In 1739 he published an octavo volume entitled: "Philosophical experiments: containing useful and necessary instructions for such as undertake long Voyages at Sea; showing how Salt-water may be made fresh, wholesome, and how Fresh Water may be preserved sweet; how Biscuits, corn, &c., may be secured from the Weavel, Maggots, and other Insects; and Flesh preserved in Hot Climates by salting Animals whole; to which is added an account of Experiments and Observations on Chalybeate or Steel-waters, with some Attempts to convey them to distant places, preserving their virtues to a greater degree than has hitherto been done; likewise a proposal for cleansing away Mud, &c., out of Rivers, Harbours, and Reservoirs." This work, which contained so many useful instructions for voyagers, was dedicated to the Lords of the Admiralty.

In the same year he reported to the Royal Society an account of some "further experiments towards the discovery of a medicine for dissolving the stone in the kidneys and bladder, and preserving meat in long voyages," and it was for this that he received the gold medal of "Sir Godfrey Copley's donation." In the following year he published an account of some experiments and observations on Miss Stephens' medicines for dissolving stone, in which their dissolving power was inquired into and demonstrated. This work on stone was subsequently translated into French.[16]

The contributions of Hales to the "Philosophical Transactions" were numerous and dealt with a great variety of topics. Besides those which are mentioned elsewhere in this article the following may be enumerated:

A Method of conveying Liquors into the Abdomen during the operation of Tapping. IX, p. 8.

A Proposal to bring Small Passable Stones Soon and with ease out of the Bladder. IX, p. 159.

Remarks on Dr. Cromwell Mortimer's paper on a new metallic thermometer. IX, p. 407.

A Proposal for Checking in some Degree the Progress of Fire. IX, p. 498.

Remarks concerning some Electrical Experiments. IX, p. 534.

Of the strength of several of the principal Purging Waters, especially that of Jessop's Well. X, p. 48.

Of some Trials to keep Water & Fish sweet, with Lime-water. X, p. 551.

Of the great Benefit of Blowing Showers of Fresh Air up through Distilling Liquors. X, p. 635.

Of Some Trials to cure the Ill Taste of Milk which is occasioned by the Food of Cows, either from Turnips, Cabbages, or Autumnal Leaves, &c. Also to Sweeten Stinking Water. X, p. 642.

Whenever these papers seemed to him to be of value to the public or to deal with topics of general interest, he would publish a popularized version in the *Gentleman's Magazine.*[17] But besides these abstracts this magazine contains numerous articles from his pen, of which the following are the more important:

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[10] "He (Hales) had learned to interrogate but not to cross examine nature." F. H. Butler: History of Chemistry, Encyclo. Brit.

[11] See Herman Kopp: Geschichte der Chemie. Braunschweig, 1845.

[12] F. D.

[13] D. N. B.

[14] Title: "Of the Plants Halesia and Gardenia." "In a letter from John Ellis, Esq., F. R. S., to Philip Careret Webb, Esq., F. R. S. The intent of the letter is to exhibit the characters of two new genera of plants growing in Mr. Webb's garden, which Mr. Ellis calls after Dr. Hales of Teddington and Dr. Garden of South Carolina." P. T., XI, 508.

Francis Darwin appears to be in error in the statement that John Ellis was governor of Georgia. The governor was Henry Ellis, F. R. S., arctic explorer and hydrographer, also governor of Nova Scotia.

[15] See Bulletin of the Johns Hopkins Hospital for July, 1904.

[16] "Etat de la Medicine, etc., par M. Clifton," translated by M. l'Abbé des Fontaines, "avec les Espériences sur le Remede de Mlle. Stephens, fait par M. Hales," etc., translated by M. Cantwell of the Royal Society, doctor of the Faculty of Montpellier. Paris, 1742.

A description of a Back-Heaver, *which will winnow and clean corn, both much sooner and better, than by the common methods of doing it.* July, 1745, XV, 353.

A Description *of a very great Improvement which is made to the* Back-Heaver; *which will not only winnow corn much sooner and better than any other methods hitherto used; but will also clean and clear it of very small Corn, Seeds, Blacks, Smut Balls, &c., to such perfection as to make it fit for Seed Corn.* July, 1747, XVII, 310.

A Description of a Sea Gage, to measure unfathomable Depths. May, 1754, XXIV, 215.

A Proposal for the more speedily and effectually curing Men, Ships, and Goods, of Pestilential Infection. Dec., 1754, XXIV, 543.[18]

Rational and easy method to purify the Air, and regulate its heat in Melon-Frames and hot Green-houses. April, 1757, XXVII, 165.

The year 1741 is ever memorable in the history of Hygiene, for it was in this year that three persons of very different stations in life conceived the idea of constructing ventilators. These persons were Sutton, a coffee-house keeper in Aldersgate Street; Martin Triewald, captain of mechanics to the King of Sweden, and the Rev. Dr. Hales.

The methods devised by Hales and Triewald seem to have been identical, and the history of their invention is told by Hales in his book on Ventilators published in 1743. From the introduction of this work, it appears that in the beginning of September, 1740, Hales wrote to Dr. Martin, the physician to Lord Cathcart, the general of the forces which lay embarked at Spithead, for an expedition in America, to propose (besides the usual sprinkling between decks with vinegar) the hanging up very many cloths dipped in vinegar in the proper places between decks, in order to make the air more wholesome: and in case an infectious distemper should be in any ship, to cure the infection with fumes of burning brimstone. "It was from these considerations, which often recurred to my Thoughts, that it occurred to me in the March following that large Ventilators would be very serviceable, in making the Air in Ships more wholesome; this I was finally so fully satisfied of, that I immediately drew up an account of it; several coppies of which were communicated, both by myself and others, to many Persons of Distinction and Members of the Royal Society: before whom I laid a large Account of it . . . .

"November the 6th following . . . . Martin Triewald, Captain of Mechanics *and Military* Architect *to the King of* Sweden, *and Fellow of the* Royal Society *at* London, *in a Letter to* Cromwell Mortimer, M. D., and secretary of the Royal Society, says that this Spring he had invented a Machine, for the use of his Majesty's Men-of-War, which went to block up Petersburg, in order to draw out the bad Air from under their Decks, the least of which does exhaust 36172 cubick Feet of Air in an Hour . . . . "

"It was a very extraordinary Circumstance that two Persons at so great a distance from each other, without getting a Hint of it, one from the other, should happen to hit on inventing a like useful Engine."

For this invention Triewald was granted a privilege for life by the King and Senate of Sweden. He then wrote a "deduction" on the usefulness of ventilators which the King caused to be distributed among his naval officers. This "deduction" was read before the Royal Society in 1742. In it Triewald recommends the use of ventilators "in Hospitals and Barracks for the sick, Men-of-War and Hospital Ships."

The book, of which the introduction above quoted forms a part, was dedicated by Hales to "the Commission for executing the office of Lord High Admiral," and in the list of its members is found the name of the Right Honourable Lord Baltimore. An idea of its contents may readily be obtained from its very lengthy title, which is as follows: "A Description of Ventilators: whereby Great Quantities of Fresh Air May with Ease be conveyed into Mines, Goals, Hospitals, Work-Houses and Ships in Exchange for their *Noxious Air.* An Account of their GREAT USEFULNESS in many other Respects: As in Preserving all Sorts of Grain Dry, Sweet, and free from being Destroyed by WEAVELS, both in GRAINARIES and SHIPS: And in Preserving many other Sorts of Goods. As also in drying, CORN, MALT, HOPS, GUN POWDER, &c., and for many other useful purposes."

The Hales ventilators were nothing more than ingeniously contrived bellows which sucked the foul air from the rooms or spaces to be ventilated and blew it out of doors. When large, these bellows were worked by means of a wind-mill; when small, by hand. The ventilator fixed in Newgate by order of the Lord Mayor and Aldermen of London was a large one and was connected by a system of tubes with twenty-four wards. It is figured and described in detail in the *Gentleman's Magazine.*[19]

Not content with playing the part of a mere inventor, Hales added to that role that of the philanthropist, for seeing that it would be of great benefit to humanity, he wrote constantly on the subject and used what influence he had to obtain the introduction of his ventilators. Success crowned his efforts. In a few years his ventilators had been put not only into Newgate and the Savoy prison,[20] but also into the Winchester

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[17] See G. M., July, 1755, XXV, 310. April, 1747, XVII, 200. March, 1756, XXVI, 130. December, 1749, XIX, 554. February, 1756, XXVI, 78. September, 1757, XXVII, 410. November, 1757, XXVII, 503.

[18] The method consisted essentially in fumigation by means of burning a mixture of brimstone and charcoal. Persons subjected to the fumes were to have their faces properly covered to prevent suffocation.

[19] "*A description of Dr. Hales* on Ventilators *fixed in* Newgate; where *being worked by a Windmill they draw foul Air out of the several Wards; which were made by* Mr. Stibbs, *Carpenter in* Fore Street, London Wall." G. M., April, 1752, XXII, 179.

Gaol,[20] the Durham County Gaol,[20] then the Gaols of Shrewsbury,[21] Northampton[21] and Maidstone.[21] The results were remarkable. During the first four months after their introduction into Newgate, the death rate was reduced by more than fifty per cent, while in the Savoy prison the rate fell from fifty or a hundred per annum to one or two per annum. Equally gratifying were the results at the smallpox hospitals. This institution contained thirty-two rooms, each accommodating two patients, and here the mortality was soon reduced to two-thirds of what it had formerly been.

Meanwhile at the recommendation of the French Academy the whole French fleet had been equipped with Triewald ventilators and many English vessels had adopted those devised by Hales. Excellent results followed, as can be seen from such letters as the following, which was published in the *Gentleman's Magazine:*[22]

> A letter from Captain Ellis, on his late Arrival from a Guinea Voyage, to the Rev. Dr. Hales.
>
> Sir,
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> Could anything increase the pleasure I have in a literary intercourse with you, it would be to find that it answered your end in promoting the publick good. . . . . Those [ventilators] of your invention which I had were of singular service to us; they kept the inside of the ship cool, sweet, dry, & healthy: The number of slaves which I buried was very inconsiderable, and not one white man of our crew (which was 34) during a voyage of 15 months; an instance very uncommon. The 340 negroes were very sensible of the benefits of a constant ventilation, and were always displeased when it was omitted. Even the exercise had an advantage not to be despised among people so much confined."

Ellis adds, however, that we must not forget that there are other causes of sickness at sea, infections brought on board, bad food and insobriety. On the last factor he dwells at some length, and to the unusual sobriety of the crew he ascribes some of their good health. His conclusion is as follows: "Could I but see the immoderate use of spirituous liquors less general, and the benefit of ventilators more known and experienced, I might then hope to see mankind better and happier."

It was without doubt the receipt of such letters as these that prompted Hales to report before the Royal Society "On the Great Benefits of Ventilators in many Instances in Preserving the Health and Lives of People, in Slave and Transport Ships."[23]

The *Gentleman's Magazine* also contains the following articles: On keeping corn sweet in heaps: Dec., 1745, XV, 640; Dr. Hales' *method to keep corn sweet in sacks:* July, 1745, XV, 354; *An Account of several methods to preserve* CORN *well by* VENTILATION: June, 1746, XVI, 315.

The last of the articles which have just been enumerated was accompanied with plates and contained a careful and minute description of the construction of granaries, with calculations regarding the size of the ventilator and the amount of air required for drying a certain amount of a given kind of grain in layers of such a depth in granaries of such a size and so forth, all this showing his painstaking accuracy and his detailed knowledge of the subject.

The ventilator which was invented by Sutton, the coffeehouse keeper above mentioned, was "of another construction,"[24] being designed "to draw off the foul air on board ships by means of the cook-room fire."[24] Sutton did not fully recognize the importance of his idea, so that it would have been forgotten had it not been for Dr. Mead, who brought it to the attention of the Royal Society. The method was so simple and satisfactory that it could not but replace in part at least the method of Hales. But, as the editor of the *Gentleman's Magazine* says, "The public, however, is not the less indebted to the ingenuity and benevolence of Dr. Hales, whose ventilators came more easily into use for many purposes of the greatest importance to life, particularly for keeping corn sweet, by blowing through it fresh showers of air, a practice very soon adopted by France, a large granary having been made under the direction of Du Hamel, for the preservation of corn in this manner, with the view to making it a general practice."[25] Here the editor refers to Duhamel du Monceau,[25] F. R. S., the celebrated French botanist and agriculturist, who, at the suggestion of Hales, equipped one of the public granaries with a wind-mill and ventilators to draw up air through the grain.

It was probably through Duhamel's influence that Hales persuaded Louis XV to introduce his system of ventilating into the French prisons in which British soldiers were confined.[26] On this occasion, writes the chronicler, "the venerable patriarch of Teddington was heard merrily to say 'he hoped no body would inform against him for corresponding with the enemy.'"[27]

Among Hales' numerous contributions to the literature of stone in the bladder and kidney, one is of special interest as showing his method of dealing with this question and his zeal in exposing quackery. It is a letter to the editor of the *Gentleman's Magazine*,[28] which runs thus:

> "*Mr.* Urban, If you please to put the following Remarks on the *Liquid Shell* into your next Magazine, you will do good service to the publick. I am, Sir, &c.
>
> "*Some* Remarks on the *boasted* Liquid Shell. The newspapers having frequently repeated a long advertisement in praise of the *Liquid Shell*, as a powerful dissolvent for the stone and gravel, I thought it of importance to enquire, by proper tryals, whether it had that boasted efficiency or not; and, if not, to caution

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[20] "*An Account of the good Effects of Ventilators, in* Newgate *and the* Savoy Prison." G. M., February, 1753, XXIII, 70.

[21] "*A further Account of the Success of Ventilators &c.*" G. M., March, 1754, XXIV, 115.

[22] G. M., March, 1754, XXIV, 114. See also G. M., August, 1750, XX, 379.

[23] P. T., X, 641.

[24] P. C., page 275.

[25] Henri Louis Duhamel du Monceau, 1700-1782.

[26] See Michaud: Biographie Universelle, article on Hales by Lefebvre Cauchy.

[27] F. D.

[28] G. M., October, 1746, XVI, 520.

people against throwing away their money, and hazarding their lives, by the use of an unefficacious medicine.

"Having therefore procured some of the *Liquid Shell*, which is a clear transparent liquor, I put into it a human stone formed in the urinary passages, upon which a very white sediment precipitated; and there was a like white sediment when a few drops of spirit of harts-horn were dropped into the same liquor; which fully proves that it was in both cases the lime of burnt shell, and not the parts of the dissolved stone as is pretended; for there was no stone put in with the spirit of harts-horn. Besides this precipitated matter is much too white for any part of dissolved stones.

* * * * * * *

"And, whereas, it is said in the advertisement, 'That, if the stone be put into a vial of the Liquid Shell, in a moderate sand heat, it will in a few hours be dissolved or broken to pieces:' On the contrary, it has been found, that, on putting human stones, of different degrees of hardness, into a vial of the Liquid Shell, they have *not* been dissolved, *nor* broken in pieces, though they continued in that state, not a few hours only, but many days; the last four hours of which time, the vial of Liquid Shell was put into scalding hot water, ... "

"Soap lie," he then states, is a powerful solvent of stones, but on evaporating the medicine to dryness only a minute quantity of this material was obtainable, and he therefore concludes thus:

"Hence we see how improbable it is that *this Liquid Shell* 'given every four hours in the quantity of 70 drops in a dose,' should have any efficiency to dissolve stones in the body," especially since it has been shown that "three pints of lime water a day, with a considerable quantity of soap, have been found necessary to be taken, in order for any probability of success, (as may be seen in the *Edinburgh* Medical Essays) . . . . "

Among the book notices for the following year is "Dissertation on the Liquid Shell pr. 6 d."[29] This pamphlet, like the article in the *Gentleman's Magazine*, was anonymous.

Dr. Holmes has made us all familiar with the subject of Bishop Berkeley's "Tar Water." In the words of a wag writing in the *Gentleman's Magazine*,[30]

> "To ev'ry med'cine is assigned its part,
> "*Sena* is purging, *saffron* warms the heart;
> "Blood sweet'ning juice to *sassafras* is given,
> "To *tar drink*—every virtue under heaven."

On the subject of tar water Hales shows a praiseworthy caution. He does not deny its efficacy, but he does not advocate its use. His only publication in the *Gentleman's Magazine*[31] is a letter received by him from Bishop Berkeley, upon the contents of which he makes no comment. In the book which he wrote on this subject, he confines himself entirely to the chemistry and preparation of tar water. This book, which bears the following title: "An Account of some Experiments and Observations on Tar-Water Wherein is shown the Quantity of Tar that is therein. Which was read before the Royal Society. By Stephen Hales, D. D., F. R. S.," closes with the following paragraph: "It is hoped that the Light given by these Researches, may be of use in Skillful Hands, for regulating and adapting the due Proportions of the acid and the oily Principles, to different Cases and Constitutions. This is the proper Province of the Physician, which I am in no ways qualified to meddle in."

Among the subjects which Hales regarded as of great importance was the liquor question. In a letter dated 1758, written by him to Mark Hildesley, Bishop of Sodor and Man, he speaks of having for the last thirty years borne public testimony against drams "in 11 different books and newspapers," and adds that this circumstance "has been of greater satisfaction to me than if I were assured that the means which I have proposed to avoid noxious air should occasion the prolonging the health and lives of a hundred millions of persons."[32]

His most important pamphlets on this subject are entitled "A Friendly Admonition to Drinkers of Brandy and other Distilled Spirits" (published anonymously), and later, "Distilled Spirituous Liquors the Bane of the Nation." In his treatment of even these topics, the scientific bent of his mind is seen, for in the second of these pamphlets, he tries to arouse the interest of the landed gentry and the farming population on the ground that dram drinking decreases the appetite and lowers the demand for food. Then, not contented with anything but quantitative statements, he declares that according to his calculations the country loses £600,000 per annum owing to the distilleries in London alone.[33]

We have considered Stephen Hales as a scientist and as a philanthropist, but the question now arises, What was going on in Teddington all this time? Did the charity of Dr. Hales begin at home?

History does not record any murmurs of neglect coming from his flock. It is even said that he made some of his women parishioners do public penance for irregular behavior.[34] We are told that the little church of St. Mary owed much to his care. He enlarged the church yard "by prevailing on the lord of the manor."[34] He superintended the building of a new tower and aisle, for which he contributed £200 out of the £592 which it cost.[35]

Under his supervision the water supply of the parish was greatly improved, and Hales records in the parish register in a manner quite characteristic that the outflow was such as to fill two quart vessels in "3 swings of a pendulum, beating seconds, which pendulum was 39 + 2/10 inches long from the suspending nail to the middle of the plumbet or bob."[34]

"Peg" Woffington,[36] the celebrated actress, was one of his parishioners, and built and endowed an almshouse at Teddington, and at her death a tablet in her memory was placed in the north aisle of St. Mary's.[37]

Hales' connection with the smallpox hospital is shown in the title of an account of this institution which appeared in the *Gentleman's Magazine.*[38] This title reads as follows:

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[29] G. M., November, 1747, XVII, 548.

[30] G. M., February, 1747, XVII, 81.

[31] G. M., February, 1747, XVII, 64.

[32] Butler: Life of Hildesley, 1799. F. D.

[33] F. D.

[34] Parish register, F. D.

[35] L. L., III, 505, note 14.

[36] Margaret Woffington, born in Dublin, 1714, died, 1760.

[37] L. L., II, 506.

"Middlesex. *Of the County Hospital for the* SMALL POX, *the Duke of* MARLBOROUGH *and the Lord Bishop of* WORCESTER, *Presidents. Sir* HUGH SMITHSON *and Sir* ROVER NEWDIGATE *Barts. the Hon. Col.* BOCKLAND *and the Rev. Dr.* HALES *Vice-Presidents.*

"For several years Hales was honored with the esteem and friendship of his Royal Highness Frederick, Prince of Wales, who frequently visited him at Teddington, from his neighboring palace at Kew, and took a pleasure in surprising him in the midst of those curious researches into the various parts of nature which almost incessantly employed him."[39]

His contemporaries admired his "social virtue and sweetness of temper" and "the constant serenity and cheerfulness of his mind."[40] Pope, who was his neighbor and of whose will Hales was one of the witnesses,[41] was heard to say, "I shall be very glad to see Dr. Hales; I always love to see him; he is so worthy and good a man."[42]

To the end of his long life his mind was ever actively planning scientific experiments and benevolent enterprises. In November, 1760, his signature appears on the parish register for the last time. On Sunday, January 4, 1761, he died after a slight illness. His death was the occasion of the following article, which appeared in the January number of the *Gentleman's Magazine:*[43]

> "*The following Character of the late Dr.* Hales, *may be relied upon in every particular, and it is to be regretted that we have not more particulars concerning his useful Life from the same hand. On Sunday* the 4th instant, died, at his parsonage-house at *Tedington*, universally lamented, in the 83rd year of his age, the Rev. Dr. *Stephen Hales*, F. R. S., member of the royal academy of sciences at *Paris* and clerk of the closet to her Royal Highness the Princess Dowager of *Wales*. If any man might ever be said to have devoted his whole life to the public, to all mankind, it was Dr. *Hales*. He possessed a native innocence and simplicity of manners, which the characters of other men, and the customs of the world, could never alter; and though he often met with many unworthy objects of his kind and charitable offices, yet they never once lessened his natural and unwearied disposition of doing good and relieving distress. His temper, as well as the powers of his understanding, were happily fitted for the improvement of natural philosophy, possessing, as he did, in an uncommon degree, that *industry and patient thinking*, which Sir *Isaac Newton* used modestly to declare, was his own only secret by which he was enabled so fortunately to trace the wonderful analysis of nature. Dr. *Hales* began his inquiries into natural knowledge very early in life, and he continued it uniformly as his darling amusement, being engaged in experiments until within a few weeks of his death. His industry had this farther excellence, that it was always pointed at the general good of his fellow creatures, agreeable to the almost unlimited benevolence of his heart; and being animated with the success of some of his more useful discoveries, his knowledge appeared to everybody near him to feed his mind with a nourishment which gave him, in the decline of his life, and even in its last stages that vigor and serenity of understanding, and clearness of ideas, which so few possess, even the flower of manhood; and which he used often to say, he valued as the most perfect of human pleasures.
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> " . . . .
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> "There are two things in his character, which particularly distinguish him from almost every other man; the first was, that his mind was so habitually bent on acquiring knowledge, that, having what he thought an abundant income, he was solicitous to avoid any farther preferment in the church,[44] lest his time and attention might thereby be diverted from his other favorite and useful occupations.
>
> "The other feature of his character was no less singular: He could look even upon wicked men, and those who did him unkind offices without any emotion of particular indignation; not for want of discernment or sensibility; but he used to consider them only as those experiments which, upon trial, he found could never be applied to any useful purpose, and which he therefore calmly and dispationately laid aside."

In accordance with his own directions he was buried in the vestry under the tower of St. Mary's which he had built eight years before. The tablet over his grave tells us that—

"Here is interred the body of Stephen Hales, D. D., clerk of the closet to the Princess of Wales, who was minister in this parish 51 years. He died the 4th of Jan., 1761, in the 84th year of his age."

In the September number of the *Gentleman's Magazine* of the following year we find this notice:[45]

> "Thursday the 2nd was opened in Westminster Abby, a fine new monument,[46] erected by Mr. John Wilton, statuary to her majesty, at the expense of the Princess Dowager of Wales, to the memory of Stephen Hales, D. D. & F. R. S., Clerk of the closet to the Princess Dowager, minister of Teddington in Middlesex, and rector of Farrington in Hants; grandson of Sir Robert Hales, of Beakesbourne in Kent, Bart. & uncle to the present Sir Thomas Hales. He died in January, 1761, aged 82 years."

There is, then, a monument to Stephen Hales in Westminster erected by the mother of George II, but it is not by means of this piece of marble that the memory of Stephen Hales is kept green among us. He has left us a memento more unique and enduring in the "Statical Essays" and the Hales manometer.

BIBLIOGRAPHY.

The more important sources which have been consulted in the preparation of the foregoing article, together with such abbreviations as have been used to designate them in the footnotes, are the following:

1. The separate publications of Hales.
2. Numerous articles by or referring to Hales in the Phil-

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[38] G. M., June, 1747, XVII, 270.

[39] P. C., 277.

[40] F. D.

[41] Courthope: Life of Pope, F. D.

[42] F. D. In the phrase "Plain parson Hale," (Moral Essays, Epistle II) Pope doubtless refers to Hales whose correct name unfortunately could not be made to rhyme with "fail" in the preceding line.

[43] G. M., January, 1761, XXXI, 32.

[44] The King offered Hales the canonry of Windsor which the latter, however, declined. L. L. and P. C.

[45] G. M., September, 1762, XXXII, 444.

[46] For epitaph see L. L., III, 507, note 19.

osophical Transactions of the Royal Society of London, abridged, London, 1809. Designated P. T.

3. Numerous articles by or referring to Hales in the *Gentleman's Magazine,* London. G. M.

4. An especially important article in G. M., June, 1764, XXXIV, 273, entitled, "*Some Account of the Life of the Late excellent and eminent* Stephen Hales, *D. D., F. R. S., Chiefly from Materials communicated by* P. Collinson, F. R. S." P. C.

5. D. Lysons: Environs of London, London, 1795, Vol. III. L. L.

6. In a number of instances the author has been unable to reach the original sources and has quoted from the very excellent account of Hales given by Francis Darwin in the Dict. National Biography, XXV, 33. Such quotations are designated by the initials F. D. which follow the title of the original source when this is known.

7. Other articles in the Dict. Nat. Biog. D. N. B.

A CASE OF CANCER OF THE MAMMA CURED BY MEANS OF ROENTGEN RAYS.

Communicated by Professor E. Schiff (*Vienna*).

The first note on cure of cancer by Roentgen rays was given by Gocht.[1] It referred to a woman of 54 years who had come to be treated of a cancer on the right mamma, ulcerated and inoperable. Considering the pains and *solaminis causa* the patient was submitted to a daily treatment. The patient felt relieved and the pains entirely disappeared. The 7th day sudden elevation of temperature and appearance of erysipelas extending from the thorax to the back and to the right arm. After a few days profuse hemorrhages out of the ulcerated cancer and death on the 27th day, caused by cachexy and sepsis.

Another patient, aged 45, suffered from recurrence of cancer of the mamma which had been already repeatedly operated on and for the last time in 1896. Also in this case the pains decreased rapidly and reappeared only when the treatment was interrupted. No influence on the cancerous tissue was to be observed.

Later appeared the publications of Magnus Moeller,[2] Sioegren and Sederholm,[3] Steubeck,[4] and of many others.

November 6, 1901, I presented to the Imperial Medical Society of Vienna a man affected with an epithelioma suborbiculare, which had been cured by Roentgen rays. Some time later I presented two other similar cases before the same society and which had also been successfully treated. Recently Mikulicz and Fittig[5] published a very instructive case, and Exner[6] described three analogous cases.

If I now insist now with more details on a case of a cancer mammæ cured by Roentgen rays accompanying it with some drawings, I do so for two reasons:

First, on account of the most favorable result of the cure and also because I was enabled to study this case histologically. Mrs. N. N. was sent to me by Dr. Schnitzler on February 7, 1903. She showed the following symptoms: The left thorax was invaded by a tumor with large basis and of a very solid consistence. This tumor extended from the left sternal margin to the axillary cavity where it reached the glands and formed a hard bunch. On its greatest wideness the tumor had 8 centimeters and its highest elevation was 5 centimeters. The surface was ulcerated, giving issue to a fetid matter, very slightly bleeding even when slightly touched. The inferior periphery showed ten or twelve small tumors of about the size of a hazelnut, also very slightly bleeding. On the back of the patient were five similar noduli. Beneath the above-mentioned bunch of the armhole existed a crateriform cavity wide enough to admit a pigeon egg. The edges were gangrenous and the basis necrotic and full of purulent matter. The glands, both supra and infraclavicular, hard and resistent. The patient said that she suffered since 11 years from pungent pains. Dr. Schnitzler's diagnosis was: Inoperable cancer en cuirasse of the left mamma with lenticular metastases of the cutis.

Although I was for a long time anxious to catch a case of this kind in order to try a Roentgen cure, I confess that the present case left me very little chance of success. *Solatii causa,* I nevertheless decided to proceed, and already, after the third sitting, the pains considerably decreased and the purulent secretion diminished. I then took the photograph of the patient (Fig. 1), which already shows a modified appearance of the state on February 7. The ulceration was considerably cleaner and scarcely purulent, the tumefaction of the heart nearly wholly reduced and the cutaneous metastases in way of full reconstitution and their volume considerably lessened.

During the treatment I could observe nearly daily an improvement. In the interval appeared slight phenomena of reactive inflammation of the surrounding skin, and so I interrupted the Roentgen treatment. The pathological process showed evidently favorable modification.

June 5 I noticed that, excepting some superficial excoriated parts, a flat scar crossed by some enlarged capillar vessels had taken the place of the former tumor. The cutaneous metastases had disappeared and the groups of glands on the supra-

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[1] Fortschritt auf dem Gebiet der Roentgenstrahles, Bd. I, Heft 1.

[2] Bibliotheca Medica, 1900.

[3] Fortschr. a. d. Geb. d. Roentgenstrahles, IV.

[4] Archives d'électricite médicale, 1901.

[5] Beiträge zur klinischen chirurgie, Bd. 37.

[6] Wiener klinische Wochenschrift, 1903.

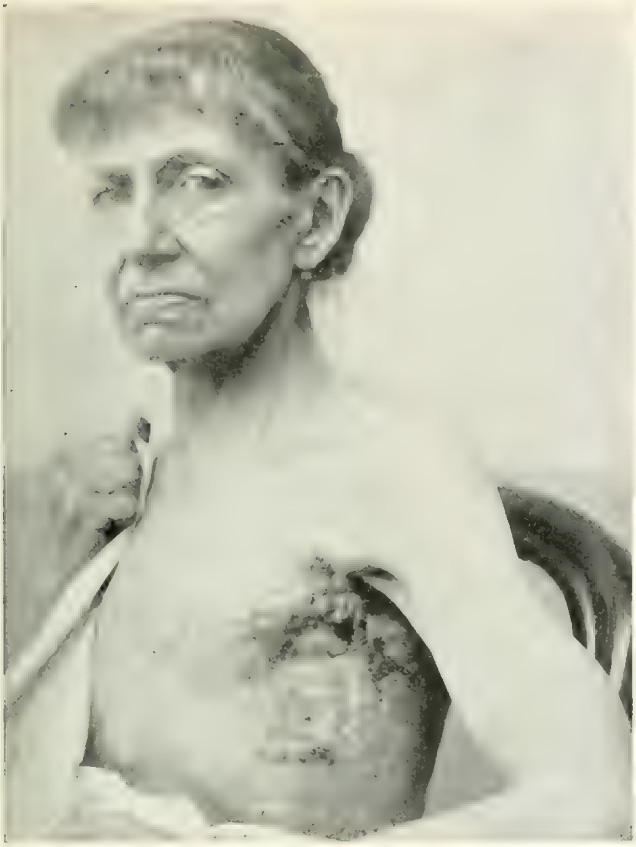

Fig. 1.

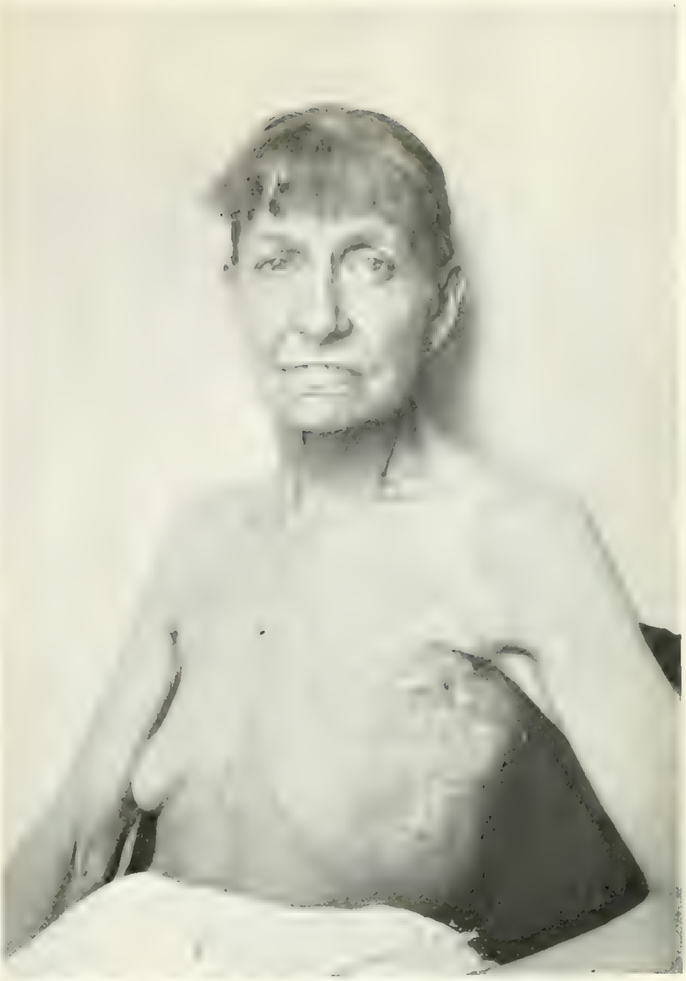

Fig. 2.

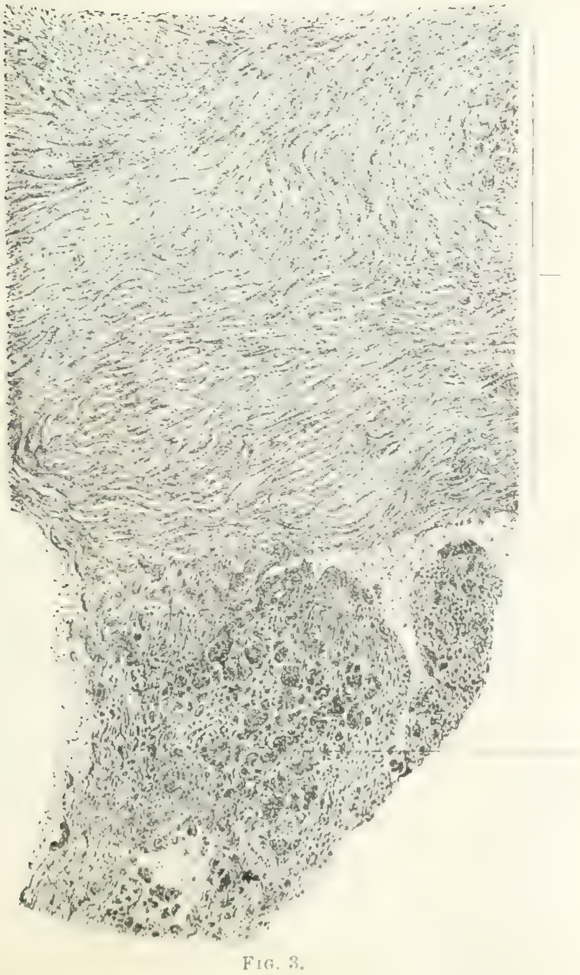

Fig. 3.

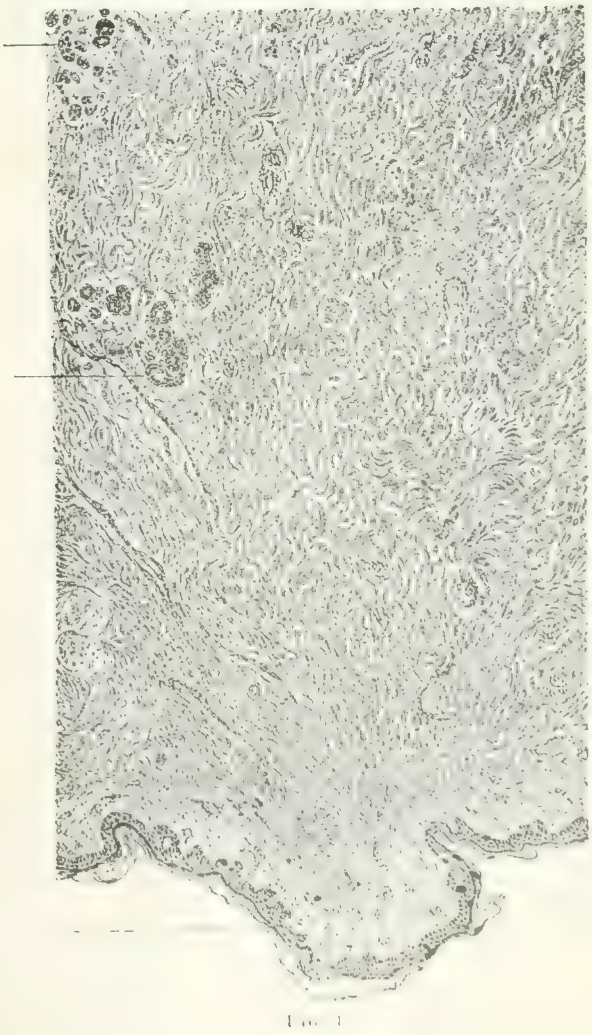

Fig. 4.

and infraclavicular region had greatly decreased and were soft (Fig. 2). The general state of the patient had very much improved.

In order to know exactly the histological condition of the case, I requested Dr. Stoerk, of the Pathological Institute of the Vienna University, to make a microscopic examination of some excised parts. The examination included:

1. A fragment of a lenticular nodulus of the back which by the treatment was notably diminished in its size.
2. Fragment of the granulated surface of the cancerous ulceration.
3. A fragment of the region in course of reconstitution surrounding the ulcerated surface and excised near the precedent fragment.

Dr. Stoerk gave the following account:

1. The greater part of this fragment consists of a tissue of large fibers very poor of nuclei and of the type cicatricial tissue; it consists of threads of homogeneous fibers. In the interstitials of these fibers mono- and polynuclear leucocytes; in the deeper part of this fragment remains of cancerous tissue in shape of small bundles of solid cellules, among which is seen a stroma of very thin fibers distinct from the larger fibers above mentioned.
2. Section from the fragment of the ulcerated surface showing the normal appearance of a granulated tissue with a great number of new-formed capillary vessels ranged in typical order.
3. In the part where the epidermis begins to be repaired it is of course very delicate. Underneath a large layer of cutis and in the basis exists still a small hearth of cancerous tissue composed of six or seven cones pressed together.

THROMBOSIS OF THE INTERNAL ILIAC VEIN DURING PREGNANCY.

By F. C. Goldsborough, M. D.,

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(*From the Obstetrical Clinic.*)

Thrombosis of the vessels of the lower extremities during pregnancy is of such infrequent occurrence and the statements concerning its etiology in the few cases reported in the literature are so scanty and unsatisfactory that it seems advisable to place every case of the kind upon record, particularly when definite statements can be made regarding the etiological factors concerned.

It is my intention in this paper to report a case of thrombosis of the left common iliac vein and its branches, which occurred in the obstetrical department of the Johns Hopkins Hospital, in the service of Prof. J. Whitridge Williams, to whom I am indebted for the privilege of this report.

After carefully reviewing the literature, I have been able to collect but ten cases of phlebitis occurring during pregnancy, though, unfortunately, the reports of three of them, Bradford, Commandeur and Dickinson, are lacking in many important details.

In the cases of Bonnet-Laborderie and Gripat the thrombosis occurred in both legs. In the former, the left internal saphenous vein was affected, while the location of the lesion in the right leg was not stated, the author designating the condition as spontaneous phlebitis. In the latter, the right femoral vein was thrombosed, but no mention was made as to which vessel was involved on the left side. The author ascribed the condition to toxemia of pregnancy, associated with chronic anæmia resulting from paludism.

Of the five cases in which only one leg was affected, the left femoral vein was involved in the patients of Brindeau, Audebert, Saint-Ange and Bacon, while in Beaudry's case the right saphenous vein was the seat of the lesion. In no instance was the etiology perfectly clear, although several of the authors did not hesitate to suggest a definite causative factor for individual cases. Thus, Brindeau supposed that his patient had suffered from an infectious process, such as la grippe or a gastro-intestinal toxemia during the seventh month of pregnancy, to which he believed the thrombosis and albuminuria which occurred in the following month could be attributed. Bacon's patient had complained of frequent and painful uterine contractions for ten days preceding the appearance of the thrombosis, and the author concluded that "the long-continued uterine contractions may have dislodged placental masses that formed rudimentary emboli, or perhaps altered the blood composition."

In connection with these data it is interesting to ascertain the effect of a thrombosis upon the course of the subsequent labor. No information upon this point is available in the reports of Bonnet-Laborderie and Dickinson. In two other cases the pregnancy terminated spontaneously at the fifth and eighth months, respectively, while the remaining patients went on to full term and were delivered normally and spontaneously. Moreover, it is interesting to note that in only two instances did the patients suffer from fever.

In all the cases in which it was mentioned, the treatment consisted in rest and immobilization of the affected part during the acute stages of the affection; which, as far as the reports show, led to the complete recovery of all the patients.

Our case occurred in a white woman, 29 years of age, who was admitted to the obstetrical department of the Johns Hopkins Hospital on Saturday, June 6, 1903 (Obst. No. 1499), complaining of constipation, nausea and vomiting and swelling of the left leg. Her family history was negative. The patient had always been healthy except for scarlet fever at 14 and diphtheria at 20 years of age. Menstruation first appeared when she was thirteen and a half years old, after which it recurred regularly and without any disagreeable symptoms; the last period having begun on the 10th of September, 1902.

The present pregnancy, which was the first one, had been practically normal until four days before admission to the hospital. There had been no nausea or vomiting, headache or visual disturbances, and the bowels had been regular until about a week before admission, though a slight leucorrheal discharge had occasionally been noted. The patient, who was employed in another hospital, had been able to attend to her usual duties until one week before admission. Up to that time she believed that no one had suspected her condition, which she successfully concealed by wearing a specially constructed corset, which enabled her so to compress her abdomen as to conceal its enlargement, simply giving the impression of being a well-developed woman with a broad waist. A week before entering the Johns Hopkins Hospital she was compelled to go to bed on account of marked œdema of her left leg. During this period the bowels did not move, and four days later she began to suffer from nausea and vomiting.

On admission the patient was found to be a large-framed woman with no puffiness about the face or eyelids. Nothing abnormal could be made out in the heart or lungs. On inspecting the abdomen, the uterus was seen to be deflected toward the left side, where it reached as high as the costal margin. The epigastrium and upper right abdominal quadrant were greatly distended, and coils of intestine could be clearly distinguished, which could be seen to be going through vigorous peristaltic movements. The stomach was greatly distended and occupied the epigastrium. The child was of moderate size and lay in the right occipito-iliac transverse position, with its head freely movable above the superior strait.

The left leg was enormously and symmetrically swollen from the toes to the groin. There was no increase in its surface temperature, nor was it painful on pressure. The skin was white and glistening, firm and tense, and pitted readily under the finger. In the fold of the groin there was an excoriation 5 cm. long by 5 mm. broad, apparently resulting from a blister; while in the region of the knee there were several blebs, which varied from 1 to 5 mm. in diameter. On careful palpation one could not detect thrombosed vessels either in the groin or at the location of the external saphenous vein. The pulse was 80 to the minute, well sustained, with moderate tension. The vessel walls were palpable. The urine was amber in color, with a specific gravity of 1020 and an acid reaction. Sugar and albumin were not present. On standing, a moderate amount of flocular sediment was deposited, which under the microscope showed only a few epithelial and pus cells.

The patient was put to bed and the leg wrapped in cotton and elevated. The bowels were moved by an oil enema and subsequently kept well open by the use of purgatives by the mouth, though these were only partially retained, and then only with the greatest difficulty. The nausea and vomiting, however, persisted during the succeeding 48 hours, and all means employed to check it were ineffectual, so that no nourishment was retained. In spite of her low pulse and the absence of increased temperature, the patient made the impression of being very ill, so that it was determined to induce labor in the hope of relieving her.

Accordingly, at 5 P. M., June 8, a Champetier de Ribes balloon was introduced into the uterus. Four hours later labor pains supervened, which were fairly effectual and recurred at short intervals. Unfortunately the balloon burst at 3 A. M. the next morning, though the pains continued several hours longer, when they completely disappeared. At 10 A. M. the temperature was 100° F. and the pulse quite rapid, while the patient appeared considerably worse than when the bag was first introduced For this reason it was determined to deliver her at once rather than to complete the dilatation of the cervix with another balloon.

Examination under chloroform anæsthesia showed that the external os was soft and about 5 cm. in diameter, while the cervical canal was between 2 and 3 cm. long; the presenting part was still freely movable above the superior strait. The cervix was then dilated manually without great difficulty by the Harris method, after which the child was turned and extracted. The operation, however, was extremely difficult, as the uterus became tetanically contracted as soon as the hand was introduced into it, necessitating the use of considerable force in completing the version. Owing to the difficulty in extraction, the child was born dead, when it was found to be a well-formed female, 50.5 cm. long and weighing 3330 grammes. As the patient was much shocked by the operation and had bled very freely, the placenta was removed manually and a perineal laceration speedily repaired.

After being placed in bed, the patient responded fairly satisfactorily to stimulation and toward evening her condition seemed quite favorable. About midnight, however, the pulse became rapid and of poor quality, the patient became irrational and did not respond to stimulation; vomiting set in and death ensued at 3 A. M., 15 hours after delivery.

An autopsy was performed 8 hours after death by the resident pathologist, Dr. W. G. MacCallum, to whom I am indebted for the following notes: The body was that of a large, well-nourished white woman, rigor mortis present. The left leg was much enlarged and could be indented with the finger. On careful palpation a hard cylindrical mass could be felt in the inguinal region. On opening the abdomen no fresh adhesions were found in the peritoneal cavity, but many old adhesions were present about the uterus, and bound the left tube and ovary into a single mass. The stomach was much distended with gas. The pleural and pericardial cavities appeared normal and contained no excess of fluid. The pulmonary arteries were opened *in situ,* but no thrombi were found in them, nor in any of their minor branches.

On macroscopic examination, the heart, spleen, adrenals, pancreas, bladder, stomach and intestines appeared normal, while the liver and kidneys showed some evidences of degenerative changes. There was no consolidation of the lungs, which, however, were moist, purple in section, a good deal of fluid and frothy blood exuding from the cut surface. The vessels were clear and normal; the bronchi were blood-stained and contained a little mucus.

Microscopical examination showed that all the organs were considerably congested. There was marked fragmentation of the myocardium. The lungs showed evidences of œdema. There was considerable degeneration of the liver cells with signs of chronic passive congestion. The renal epithelium was extensively degenerated, but particularly in the tubules.

The lumen of the left common iliac vein was completely occluded where it was crossed by the right common iliac artery. From this point, as far down as the dissection was carried, the vessel was filled by a thrombosed mass, which extended into the external iliac and from it into the femoral and saphenous veins. On the other hand, it stopped abruptly at the point of compression, above which the vessel was perfectly normal. In places the thrombus was of a pale color and showed definite lamellæ; elsewhere it was purplish black, but even here a lamellated structure was visible. The intima of the veins was destroyed, the thrombus being firmly adherent to the vessel wall.

Microscopic sections through the thrombosed vessel showed practically no change in its walls, except for the absence of the endothelial lining. There were no signs of marked inflammatory reaction, the entire lumen being merely filled by a blood clot which was firmly adherent to its wall.

Cultures taken from the heart's blood and the thrombus at the time of autopsy were absolutely negative; nor could the most thorough examination of appropriately stained hardened specimens reveal the presence of bacteria.

The comparison of the clinical history of this case with the autopsy findings would seem to leave no doubt as to the sequence of events, and apparently shows quite definitely the causative factor in the production of the thrombosis. The negative results of the cultures made from the heart's blood and from the thrombus at the time of autopsy, as well as the absence of bacteria in suitably stained sections through the thrombus, would appear to eliminate the possibility of a bacterial origin, and therefore force us to seek some other cause.

After carefully considering all the possibilities, it seems to us that this factor is to be found in the pressure which was brought to bear upon the retro-peritoneal structures by the corset which the patient wore to disguise her condition. As the uterus enlarged, it was forced with increasing intensity by the binder downward and backward against the bodies of the lumbar vertebræ and the structures in front of them. This naturally interfered with the return of the blood from the lower extremities, which was particularly marked at the point where the right common iliac artery crossed the left common iliac vein. As the pressure increased, the latter vessel became compressed between the artery in front of it and the vertebral column behind it, so that eventually its lumen became completely obliterated, when effectual stagnation was brought about. Subsequently coagulation occurred and the thrombosis resulted with the effects already mentioned.

It would, therefore, seem more than probable, in view of the mechanical conditions present and the negative results of bacterial examination, that we have to deal in this case with thrombosis resulting from pressure. Such an occurrence is rare under any circumstances, and as far as I have been able to learn has not as yet been described as a causative factor in a thrombosis occurring during pregnancy.

Case.	Age.	Para.	Period of Gest.	Fever.	Affected Part.	Effect on Labor	Etiology.	Reported by.
1	33	3d p.	8th mo.		Lt. femoral vein.	None.	Intercurrent infection.	Brindeau.
2	27	1st p.	8th mo.		Lt. internal saph. vein right leg.	None.	Spontaneous phlebitis.	Bonnet-Laborderie.
3	28	2nd preg.	7½ mo.	?	Rt. internal saph. vein.	None.	?	Beaudry.
4	?	?	Term	?	Rt. leg and thigh.	Very incomplete account.		Bradford.
5	32	7th preg.	End of 3rd mo.		Rt. femoral and left leg.	At 8th mo. child still-born.	Anæmia and albuminuria.	Gripat.
6	30	1st p.	8th mo.	?	Left leg and thigh.	?	?	Dickinson.
7	40	2nd preg.	6½ mo.	?	Left femoral vein.	None.	?	Audebert.
8	?	?	1 mo.	–	Left femoral vein.	Miscarriage at 5th mo.	?	Saint-Ange.
9	?	3rd preg.	5th mo.	–	Rt. leg.	None.	?	Commandeur.
10	23	1st p.	8th mo.	+	Left femoral vein.	None.	See abstract.	Bacon.
11	29	1st p.	Term	+	Left common iliac vein.	Operative delivery.	Pressure thrombosis.	F. C. Goldsborough.

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CHANGES IN THE NERVOUS SYSTEM AFTER PARATHYROIDECTOMY.

By Colin K. Russell, M. D. (*McGill*).

It has been shown by Gley, Vassale and Generali and others that dogs after the extirpation of the parathyroid glands die usually in the course of a few days of a generalized tetany. Vassale and Donaggio made a series of examinations of the spinal cord of seven of such dogs. In six of these after the cord had been kept in Müller's fluid for 3-5 months, they found a macroscopical alteration thought to be a degeneration in the crossed pyramidal tracts identical in situation with that following ablation of the motor cortex, and also a similar change in the posterior tracts. This degeneration so clearly visible to the naked eye could not be demonstrated microscopically with Marchi's stain or with the Weigert-Pal method. With a 1 per cent solution of nigrosin they were able to distinguish a swelling and granular appearance of the axis cylinders, and the myeline sheath showed atrophy and did not take the stain well. They did not examine the cortex and left the question open whether this was a primary degeneration of these tracts or whether it was secondary to an atrophy of the respective cortical ganglion cells.

Through the kindness of Dr. W. G. MacCallum, I have been able to examine the brain and cortex in several of the animals of his series of experiments which he published lately and which he is still carrying on, with the object of determining if this degeneration were primary in the cortical cells.

The method used was as follows:

The motor cortex, medulla, and a section of the cord were hardened in 95 per cent alcohol for three days. They were then imbedded in paraffin and cut in sections 10 μ thick.

The sections were stained with Nissl's methylene blue, the temperature being very gradually raised until steam was given off. They were then decolorized with aniline oil 10 per cent in 95 per cent alcohol, until the stain ceased to be given off. Oil of cajuput followed by xylol and mounted in neutral balsam.

A control was obtained by killing an animal very quickly by opening both carotids and crural arteries.

The following is the synopsis of the histories of the experiments taken from Dr. MacCallum's notes with the histological findings:

Case 1.—Dog 128. Four parathyroids removed—violent tetany two days later. Thyroids then removed under ether. Violent exacerbations of tetany and death about 60 hours after first operation.

Sections made through the motor cortex show some indefiniteness in the outline of the pyramidal cells. The processes are long. In a great many cases the cells are surrounded by numerous neuroglia cells.

The cell itself shows marked chromatolysis, staining much more deeply and diffusely about the nucleus, owing to the chromophile granules which ordinarily stain distinctly having become broken up and exceedingly fine. As we approach the processes, the chromophile granules become more sparsely distributed although they extend for a very considerable distance and are frequently so placed along the margin as to give the process a roughened appearance.

The nucleus is centrally placed and as a rule has a fairly sharp outline. It takes a faint bluish tinge.

The nucleolus stains deeply.

The cord fixed in Müller's fluid shows macroscopically on cross sections pale areas confined to the crossed pyramidal tract. Although this was stained with the Weigert-Pal, Marchi and Stroebe methods and also with nigrosin 1 per cent, it has been found impossible to demonstrate any degenerative changes microscopically. This same difficulty has been found by Vassale, in his experiments.

Cutting longitudinal sections through these tracts was also tried to see if any swelling of the axis cylinders could be demonstrated but I could not satisfy myself that this was present.

Case 2.—Dog 133. Two parathyroids on right side and left lobe of thyroid together with parathyroids removed, followed by sickness and depression for 26 days before the onset of a moderate grade of tetany. Dog killed in order that blood might be transfused into another dog, 27 days after first operation.

In this dog there were found on examination scattered through the cortex and often side by side with well preserved pyramidal cells, numerous shrunken twisted pyramidal cells with tortuous processes; these cells may be very much diminished in size and are sometimes extremely narrow and dense looking. In the more intensely affected examples the chromophile granules are no longer to be made out at all, but the whole protoplasm takes a dense blue stain sometimes so intense as to completely hide the nucleus. The nucleus itself is shrunken and deeply stained. The nucleolus is frequently no longer visible. Neuroglia cells accumulated about these nerve cells seem very abundant.

In the cord there are also two conditions of the cell to be seen often side by side. In the one the Nissl's bodies are distinct and evenly scattered through the cell. They are large and irregularly shaped and extend a short distance down the processes; here they are long with the long axis parallel to the axis of the process. The nucleus and nucleolus are centrally placed, the nucleus takes a faint bluish tinge, the nucleolus staining deeply. These are practicaly normal cells.

In the second type there is a slight degree of chromatolysis especially marked in the body of the cell in the neighborhood of the nucleus. The nucleus and nucleolus are unchanged.

In the cord fixed in Müller's fluid there was no degeneration of the crossed pyramidal tract made out either macroscopically or microscopically.

Case 3.—Dog 138. Four parathyroids removed. Violent tetany two days later. Both thyroids removed with no effect. Tetany increased; bled to death under ether two days after primary operation.

The pyramidal cells show a degree of chromatolysis similar to Case No. 1. There are practically none of the shrivelled cells that are seen in Case 2, although one or two are visible.

In the medulla stained with Nissl's method, there is a slighter degree of chromatolysis than is seen in the cortex. The chromophile granules have a distinctly finer appearance than is seen in the control specimen.

The cord shows nothing abnormal except that the processes can be followed for a longer distance than they can in the control specimen.

In the cord fixed in Müller's fluid, no macroscopical degeneration can be made out nor could any be demonstrated microscopically.

Case 4.—Dog 139. Four parathyroids removed, followed by marked depression, very severe tetanic convulsions on 7th day and death.

Pyramidal cells of cortex show a chromatolysis similar to Case 1. There are a few shrivelled, distorted cells such as are seen in Case 2, but these are not at all numerous.

In the cord, while some of the ganglion cells are perfectly normal, most show a greater or less degree of chromatolysis.

The cord fixed in Müller's fluid shows no macroscopical degeneration of the crossed pyramidal tract; and in longitudinal sections through this tract I could make out no swelling of the axis cylinders.

Case 5.—Dog 141. Left motor cortex removed, followed by paresis of right side. 10 days later three parathyroids were removed from left side and the right thyroid lobe together with its parathyroids. Seven days later violent tetany, more marked on left side; noticeable on right side also. Died under ether.

The cortical pyramidal cells from the right side show a degree of chromatolysis similar to Cases 1, 3 and 4.

In the cord the cells seem perfectly normal.

There is a marked degeneration in the crossed pyramidal tract on the right side of the cord. Left side is normal.

Case 6.—Dog 148. Two parathyroids removed from right side and the thyroid lobe together with the parathyroids on left side. Tetany quite violent on the second day following. Intermittent tetany during eleven days after the operation at the end of which the dog was found dead.

In the cortex the pyramidal cells have a rather indefinite outline. There is also a marked chromatolysis, not confined as a rule to the neighborhood of the nucleus but general. Some of the cells are quite broken up.

There are very few shrivelled, distorted cells as described in Case 2. In a great many cases numerous neuroglia cells are seen surrounding the ganglion cells. The cell processes may be followed for some distance as a rule.

The nucleus in a great many cases has disappeared, in some others it is somewhat swollen and may be dislocated more or less to one side of the cell. Nucleolus stains darkly.

In the cord the cells show a fairly well marked chromatolysis. The processes can be followed for some distance from the cell. In some cases the cell is more or less surrounded by neuroglia cells. In some vessels in the posterior horn there is a marked outwandering of leucocytes and many of the cells in the immediate neighborhood are shrunken and stain very deeply and diffusely.

Case 7.—Dog 132. Two parathyroids removed from right side. Whole thyroid lobe with its parathyroids removed from left side. Great depression. Intraperitoneal injection of two thyroid glands. Cachexia and emaciation. Death 15 days after primary operation.

In the cortex the pyramidal cells have a diffuse finely granular appearance, showing marked general chromatolysis. In a few, the nucleus is somewhat laterally situated. Processes are fairly long.

In the cord, the ganglion cells show a marked chromatolysis especially about the nucleus, while near the periphery and at the beginning of the processes a few irregularly shaped Nissl bodies can be made out. A few stain diffusely throughout; no chromophilic bodies can be made out. In one of these the nucleus is protruded from the cell entirely; in others it is somewhat displaced laterally. Many cells are surrounded by unusually abundant neuroglia cells.

From the study of these brains it seems evident that when after parathyroidectomy the dogs succumb with symptoms of tetany, etc., there are to be found fairly uniform, if slight alterations in the cells of the central nervous system. These alterations consist in:

1. Chromatolysis in which the chromophile granules especially in the immediate neighborhood of the nucleus become reduced to such a fine state of division as to give a diffuse blue stain with Nissl's method. In the cases in which the tetany is of longer duration, the change may be such that isolated chromophile bodies are no longer to be distinguished in the cell. Associated with this alteration there may be a dislocation of the nucleus or even in extreme cases its expulsion from the cell. Sometimes it is possible in these cases to trace the protoplasmic processes to a great distance from the cell.

2. In most severe cases there is in many of the large pyramidal cells a change which leads to their great shrinkage and distortion, the cell protoplasm becoming so densely stained as to hide the nucleus.

3. The small neuroglia cells, of which one or two are usually associated with the pyramidal cells, may become more numerous so that each nerve cell is surrounded by a group of them. This is evidently the appearance described by Quervain and others as due to an accumulation of leucocytes in the spaces about the nerve cells. The function of these neuroglia cells is not understood, but it is thought by many that they may be of a phagocytic nature.

In the medulla and cord the alterations are similar, although far less intense than in the cortex.

Since the general conditions of life of these dogs were the normal ones and no pathological alteration was observable in the other organs, it is thought justifiable to ascribe these changes to the influence of the toxin which appears in the body after parathyroidectomy.

The macroscopic change which Vassale and Donaggio observed in the spinal cord of parathyroidectomized animals after protracted treatment of the tissue with chrome salts is described by them as an alteration not recognizable by the methods of Marchi or Weigert, although by the use of nigrosin they were able to discern a swelling of the axis cylinders and an atrophy of the medullary sheaths in the pyramidal and dorsal tracts. In only one case of this series was such a change evident, possibly because in all the others the tissue had not lain for 3-5 months, as Vassale recommends.

In conclusion, therefore, it seems that we have in the cortical cells anatomical alterations which, although very slight, are still sufficiently well marked to afford a basis for the functional changes which led to the tetany. It seems probable further that the degenerative changes in the pyramidal tract of the spinal cord observed in one case and noted so often by Vassale may represent the analogous condition of the axis cylinder processes of these same cells. Probably in time this alteration of the axis cylinder processes which is possibly secondary to the change in the nerve cell, would be associated with alterations in the myelin sheath recognizable by the usual methods.

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THE RELATION BETWEEN CARCINOMA CERVICIS UTERI AND THE RECTUM AND ITS SIGNIFICANCE IN THE MORE RADICAL OPERATIONS FOR THAT DISEASE.

By John A. Sampson, M. D.,

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The invasion of carcinoma cervicis uteri into the surrounding tissue manifests itself in the large percentage of cases admitted to this hospital in which the disease has extended so far that palliative treatment alone is indicated and also in the still larger percentage of cases in which the disease returns after operation, showing that at the time of the operation the growth had already invaded the surrounding tissue and that hysterectomy alone seldom cures this disease. In October, 1902, our cases were reviewed, and at that time in over three-fifths of the patients admitted to the hospital the growth had extended beyond operative treatment. Of 143 patients in which hysterectomy had been done, 21 died as a result of the operation, giving a primary mortality of 14.6 per cent. Three years or more had elapsed since the operation in 69 of the cases which we had been able to follow, and at the end of that time 20 were living, but 6 of these later had recurrences, thus giving a percentage of recurrences after three years and more of 78.2 per cent. When we considered those cases in which five years or longer had elapsed since operation we found that there were 49 whom we had been able to follow, and of this number the growth had returned in 43, or 87.7 per cent. We realize, however, that five years is not long enough, for two of our patients had died at the end of six and seven years from general carcinosis without a return in the vaginal vault, and a third was living, with a small growth in the vaginal scar, five and a half years after operation, there having been symptoms referable to it for only two months. We reviewed our cases again in May of this year and found that after three years or more, in 76.5 per cent the growth returned in 94 cases whom we were able to hear from, and that after five years or more the percentage of recurrence was 79.1 per cent in 67 cases heard from. This improvement over the review made in October, 1902, can be explained in two ways: first, that physicians and patients realize more and more the importance of an early diagnosis, and secondly, the operations have become more radical each year.

The importance of a more radical operation in these cases has been emphasized in previous publications[1] and also the relation between the growth and the ureters[1, 6, 7] and bladder,[2, 3] as well as the efficiency[5] of the blood supply of the ureter and also the complications[7] arising from freeing the ureter from its sheath and injury to its blood supply. The dangers[4] of ascending renal infection from post-operative cystitis have also been considered and a possible way of controlling the bladder infection has been suggested.

The relation between the rectum and carcinoma cervicis uteri should be considered, for in many instances it has a very important bearing in these operations. This relation manifests itself clinically in the posterior extension of the disease, thus involving the anterior wall of the rectum and with the necrosis of the cancerous tissue a recto-vaginal fistula is formed. Another manifestation of this relation is injury to the rectum, which may occur in hysterectomy for the disease.

The object of this paper is to see what may be learned from anatomical and pathological studies as well as clinical experience in regard to the relation between cancer of the cervix and the rectum, and if these results have any bearing on the more radical operations for this disease.

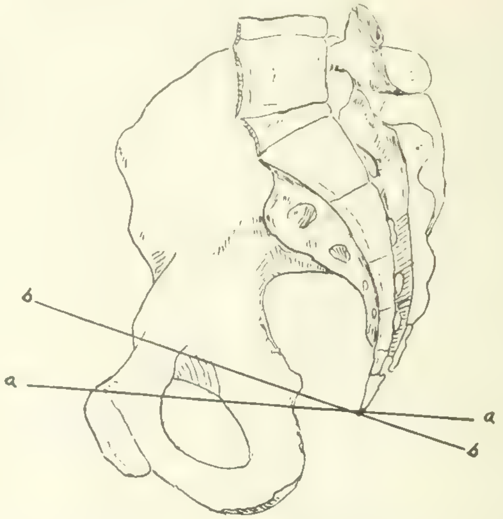

Fig. I.—View of the Inside of the Right Half of the Pelvis of a Woman Standing, × $\frac{3}{10}$. (Spalteholz).

a-a Represents a horizontal plane passed through the body from the top of the symphysis.

b-b Represents the plane at which the section shown in Fig. II was cut

Anatomical Relations between the Uterus and Rectum under Normal Conditions.

While much may be learned about the relation between the uterus and rectum from dissections and a study of the conditions found at operations, nevertheless, a study of cross sections of the pelvis probably indicates this relation more clearly than any other method. Fig. II is a drawing made from a cross section of the pelvis of a woman 30 (?) years old. The section is indicated by the line *b-b*, Fig. I, and is higher on the right than on the left side. Fig. III is a reconstruction made from the sections made in this case, and line *V* indicates the section from which Fig. II was drawn. In this case the rectum was situated in the left side of the pelvis and one can see that the relation between the two is dependent on the position of the uterus in the pelvis and that in this instance nearly the entire uterus is situated to the right of the rectum. As the uterus under normal conditions is a relatively freely movable organ, it adapts itself to the space in the pelvis in which there is the most room and its position in the pelvis is in a measure determined by the position and size of the rectum. By referring to Figs. II and III again one may see that the course of each ureter, as far as the fixed structures are concerned, as, for instance, the walls of the pelvis in Fig. II, is the same for each, but that their relation to such structures as the uterus and rectum is dependent on the position of the uterus and rectum in the pelvis. So the relation between the uterus and the rectum is dependent on the position of the uterus in the

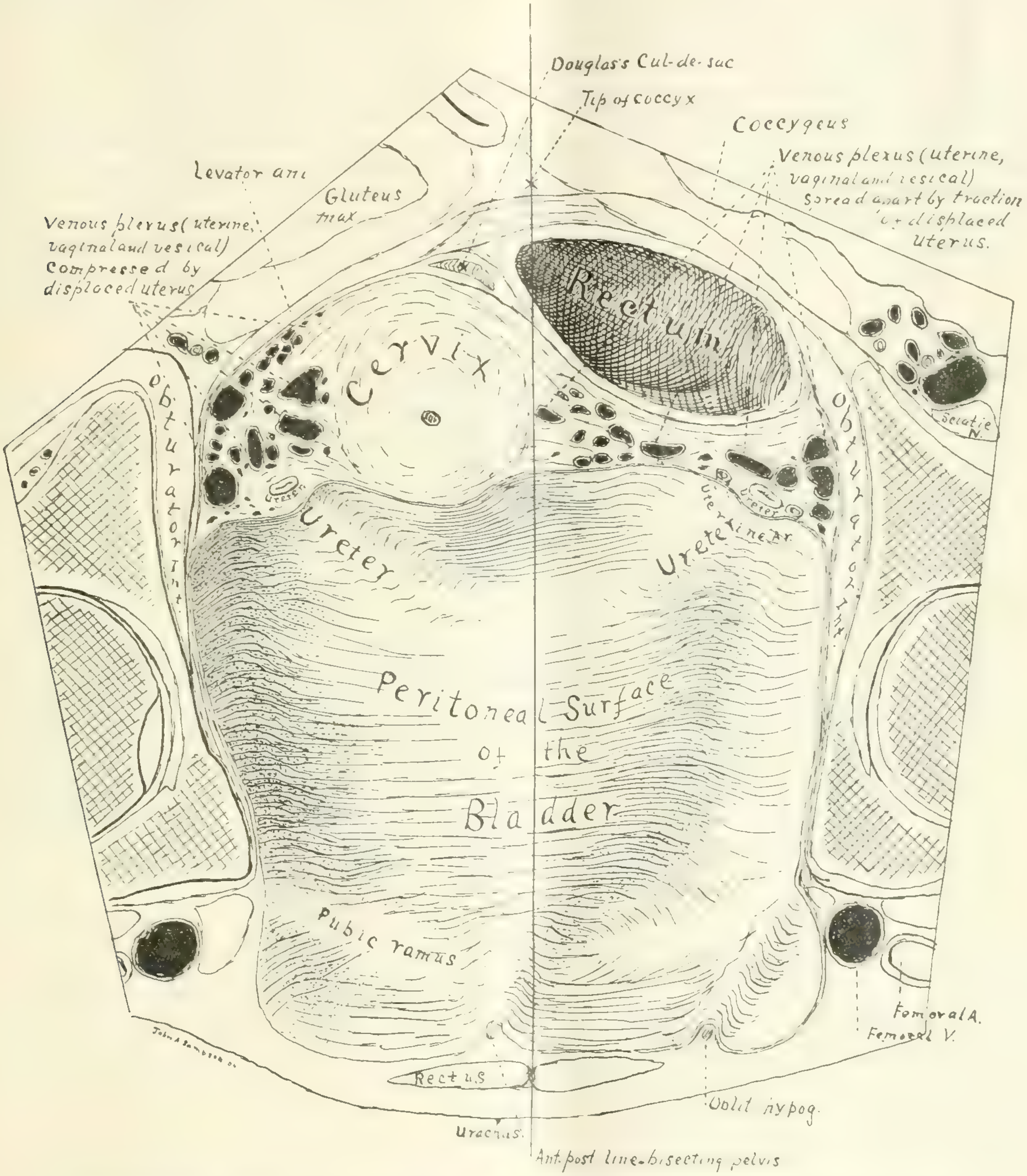
Douglas's Cul-de-sac
Tip of coccyx
Coccygeus
Venous plexus (uterine, vaginal and vesical) Spread apart by traction & displaced uterus.
Levator ani
Gluteus max
Venous plexus (uterine, vaginal and vesical) Compressed by displaced uterus
Rectum
Cervix
obturator int
obturator int
Sciatic N.
Ureter
Ureter
Uterine Ar.
Ureter
Peritoneal Surface of the Bladder
Pubic ramus
Femoral A.
Femoral V.
Rectus
Oblit hypog.
Urachus
Ant. post line-bisecting pelvis

Fig. II.—Cross Section of the Pelvis of a Multipara 30 ± Years Old, × 1. Section represented by the line b-b, Fig. I, and V, Fig. V.

Uterus is in retroposition, adherent, and in the right side of the pelvis.

Notice what an important factor the position of the cervix in the pelvis is in determining what tissue may be invaded by an extension of carcinoma cervicis uteri. The relation of the uterus to other structures in the pelvis is dependent on the position of the uterus in the pelvis.

pelvis whether in the right or left lateral position, and also whether forward or in retroposition and whether high in the pelvis or in descensus. A study of sagittal sections of the pelvis also aids in understanding the relation between the two organs. A line bisecting the uterus shown in Fig. III would cut the rectum only below the cervix, while a line bisecting the pelvis would bisect the rectum at the level of the top of the uterus, but at the level of the internal uterine os it would almost serve as the boundary line between the uterus, which is in the right side of the pelvis, and the rectal pouch, which is situated in the left side of the pelvis. The posterior surface of the uterus is covered by peritoneum and the reflexion of this peritoneum over upon the uterus forms the bottom of the so-called cul-de-sac of Douglas. The bottom of this cul-de-sac is situated at a lower level than the lower portion of the cervix when the uterus is in its normal position, and as is well known the peritoneal cavity can easily be opened by an incision through the vaginal vault posterior to the cervix (see Fig. IV). While there is a relatively broad attachment between the bladder and cervix anteriorly, the cervix is separated from the rectum by the cul-de-sac with its uterine and rectal peritoneal lining and in descensus the posterior vaginal wall is interposed between the two organs. In addition, there is adipose tissue between the anterior rectal wall and the vagina and rectal peritoneal covering of the cul-de-sac. The amount of this adipose tissue varies in different cases, as can be seen by comparing Figs. II and IV.

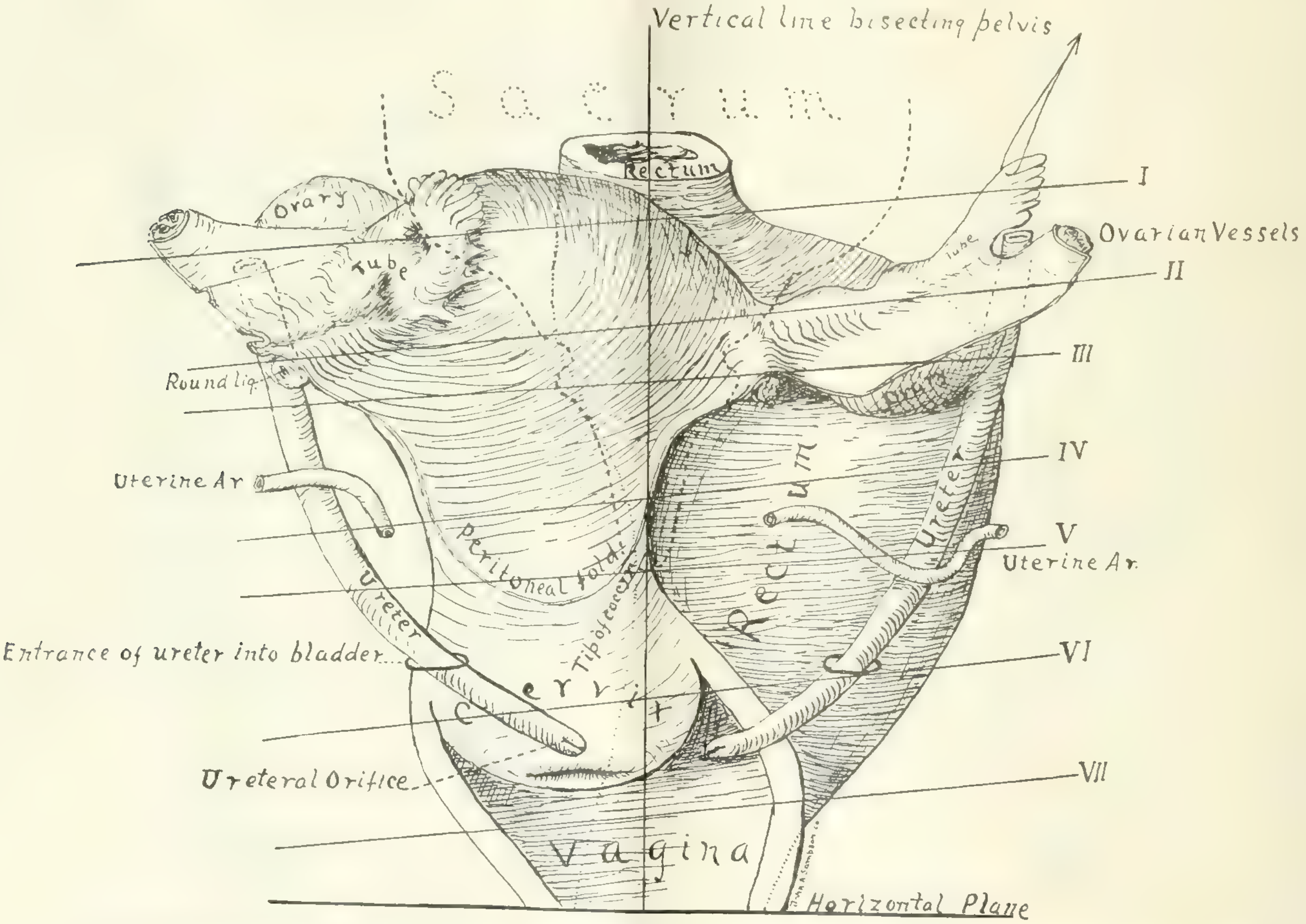

Fig. III.—Reconstruction Showing the Relation between the Cervix and Other Pelvic Structures, from Cross Sections of the Pelvis of a Multipara 30 (?) Years Old, × 1.

Reconstruction from cross sections of the pelvis of a woman, with the uterus in retroposition, adherent, and in the right side of the pelvis. Fig. II represents one of the cross sections. One may see what an important factor the position of the uterus in the pelvis is, in determining the relation between that organ and other pelvic structures, and what structures are likely to be first involved in a direct extension of the growth.

A result of these anatomical studies shows that a direct invasion of the rectum by carcinoma cervicis uteri must extend either through the cul-de-sac, which may have become obliterated by adhesions, or indirectly through the vaginal wall, which may have become involved by the growth, or else the parametrium of one side, which may be situated directly in front of the rectum, as the left parametrium is situated in Fig. II.

Relation between Carcinoma Cervicis Uteri and the Rectum.

It is difficult to understand why the growth in one case may extend in a certain direction, while in another case the direction may be different. In one specimen the growth may be confined to the anterior portion of the cervix, the bladder soon becoming involved; on the other hand, in another case the posterior portion of the cervix may be involved and the rectum may soon become invaded. There seem to be as many types of the direction in which the growth may extend as there are possibilities. We are unable to determine why the direction of the invasion of the growth may vary in different cases. The most important factor, aside from the direction of the growth, in determining the parts involved by the extension of the growth, *is the position of the uterus in the pelvis.* By referring to Figs. II and III, where the uterus is in adherent retroposition in the right side of the pelvis, one can see how easily the right ureter could become involved by the growth, while the growth would have to be very extensive in order to compress the left ureter. The rectum could be involved by the extension of the growth to the left, either through the cervix or indirectly through the vagina or left parametrium. On the other hand, when the uterus is in the left lateral portion of the pelvis or in anteposition, its relation to surrounding parts has changed, and so the portions of the pelvis invaded may be different.

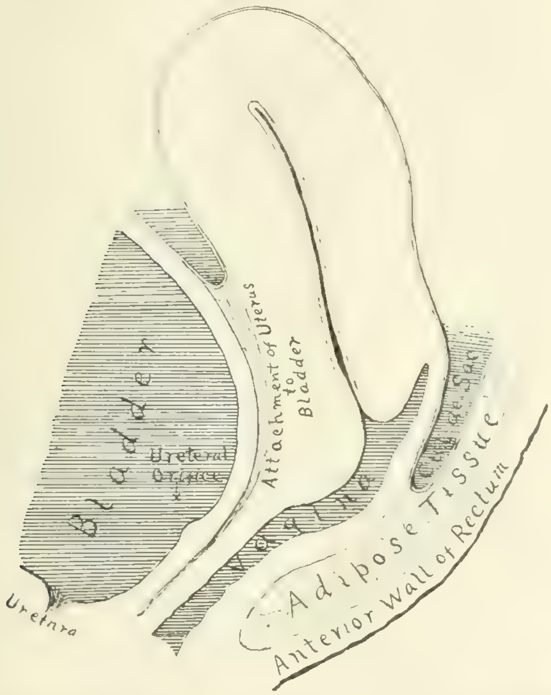

Fig. IV.—Sagittal section showing the relation between the uterus and rectum, × 1.

From autopsy specimen. Pelvic contents were removed in one mass and then hardened in formalin. Notice the large bladder attachment and that the cervix is separated from the rectum by the cul-de-sac. Carcinoma cervicis uteri must reach the rectum either through the obliterated cul-de-sac or through the vagina, which may become involved (see Figs. V and VI).

In Fig. V is represented a sagittal section of a specimen (Gyn. Path. No. 7419) in which the growth in its posterior extension has obliterated the cul-de-sac and invaded the tissue to the right of and also anterior to the rectum. The uterus was in retroposition and in the right side of the pelvis, as in Figs. II and III, so that the posterior extension of the disease for the most part after obliterating the cul-de-sac invaded the adipose tissue lateral to the rectum.

Fig. VI (Gyn. Path. No. 7370) represents how the vagina may become involved and the growth in its posterior extension may invade the rectum. The vagina is separated from the rectum by a layer of adipose and fibrous tissue and the thickness of this layer varies in different cases, depending on the amount of adipose tissue. In some cases it is very thin, while in other cases it is quite thick, as in the specimen shown in Fig. IV. When the growth has invaded the vaginal wall there is very little to hinder its invasion of the wall of the rectum.

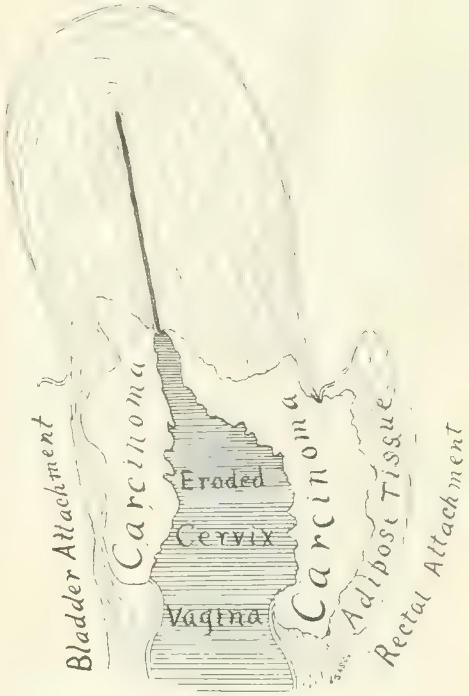

Fig. V.—Sagittal section of cancerous uterus, showing how the growth may extend towards the rectum through the obliterated cul-de-sac, × 1. Gyn. No. 11192, Gyn. Path. No. 7419.

The growth has involved both the anterior and posterior walls of the cervix and in its extension posteriorly has obliterated the cul-de-sac and invaded the adipose tissue anterior and lateral to the rectum.

Effect of the More Radical Operation for Carcinoma Cervicis Uteri on the Rectum.

In removing the uterus with the upper portion of the vagina, the anterior wall of the rectum is exposed, the amount of surface varying with the length of the vagina removed. Ordinarily the rectum is not injured by this; occasionally it is torn or a hole is cut into it by scissors or knife, but usually the vagina may be separated from the rectum through the adipose tissue between the two parts without inflicting any injury upon the rectum.

Recently I removed the uterus with pelvic lymphatics from a patient (Gyn. No. 11192) in whom the growth had extended posteriorly, obliterating the cul-de-sac as high up as the level of the internal os (see Fig. V). The uterus was in retroposition in the right lateral part of the pelvis, the rectum being in the left lateral portion of the pelvis. The growth in its posterior extension had invaded the adipose tissue lateral to the rectum and in order to obtain a wide excision of the growth the adipose tissue about the wall of the rectum near the growth was removed, together with the uterus. The result of the above was that the right side of the wall of the rectum was exposed in places injuring its outer muscular coat. The convalescence of the patient was uneventful until the sixth day. The gauze drains, two in number, which extended from each side of the pelvis out through the vagina, had been started on the third day and completely removed on the fourth and replaced by fresh ones. On the morning of the sixth day the patient's temperature rose to 103°, but there were no subjective symptoms. The patient was placed in the elevated Sims position and the vagina exposed by a Sims speculum. On removing the gauze drains in the right side an opening about 1 cm in long diameter was seen in the right side of the rectal wall, from which there was a discharge of fecal matter. At the present time, May 4, the opening still exists, and unless it heals spontaneously an attempt will be made to close it.

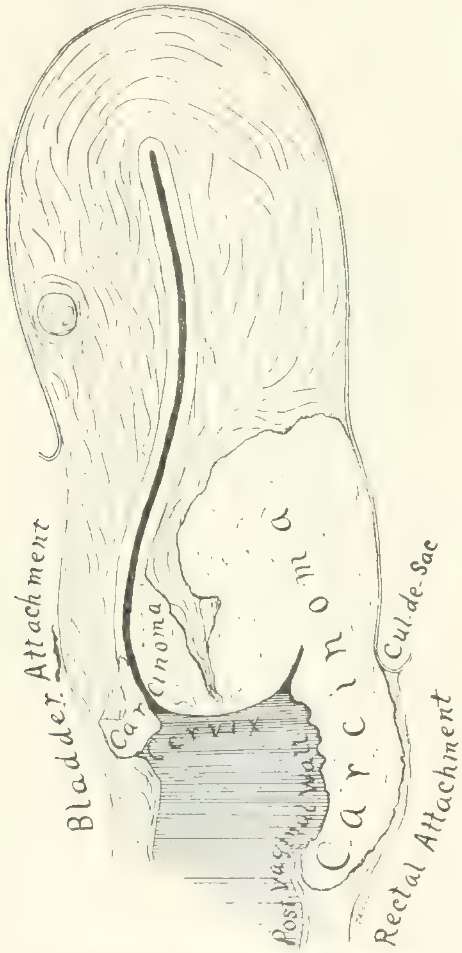

Fig. VI.—Sagittal section of cancerous uterus, showing how the growth may extend towards the rectum through the posterior vaginal wall, which is involved by the growth, × 1. Gyn. No. 11134, Gyn. Path. No. 7370.

The growth is restricted almost entirely to the posterior wall of the cervix. The cul-de-sac is intact, but the growth has extended out to the peritoneum, covering the anterior surface of the cul-de-sac. This drawing shows how the rectum may become invaded by the growth, which has involved the posterior vaginal wall.

Bearing of the Above on the More Radical Operations for Carcinoma Cervicis Uteri.

A wide excision of the primary growth is most important in all forms of cancer and especially so in cancer of the cervix, for it soon invades the surrounding parts. While one wishes to avoid injury to the rectum, the first requisite is to remove the growth. It is most important to determine before operating the position of the uterus in the pelvis and its relation to surrounding parts. If the cervix is in the right side of the pelvis and fixed, and the rectum is situated to the left, one may see how easily the rectum could be involved by the extension of the growth either through the cervix to the left or through the left parametrium, which may have become involved by the growth (see Fig. II). By making a careful bimanual examination before the operation a definite plan may be formulated, and one may know just where a wide excision is needed most.

A very good plan is to insert a rectal tube in the rectum just before the operation and let it remain there during the operation. This serves two purposes: first, it gets rid of any fecal matter or gases which may be present and keeps the rectum empty during the operation; second, it is easily palpated during the operation and serves as a means of locating the rectum, in the same manner as the renal catheter does the catheterized ureter.

At the close of the operation the peritoneum which is reflected from the rectum over the bottom of the cul-de-sac should be sutured to the posterior vaginal wall in order to cover the raw area thus exposed. The operation[6] has been described fully in a previous publication.

Conclusions.

1. The relation between carcinoma cervicis uteri and the rectum may manifest itself in the recto-vaginal fistulæ which result from a necrosis of the growth which has involved the rectum in the posterior extension of the disease, and also in accidental injuries to the rectum occurring during hysterectomy for the disease.

2. The relation between the uterus and the rectum varies under different conditions and is dependent on the position of the uterus in the pelvis, whether in normal anteposition or retroposition, and especially the left and right lateral positions of the uterus. Descensus of the uterus also changes the relation between the two organs. The position of the uterus in the pelvis is a most important factor in determining what surrounding tissue may be invaded in the extension of the growth from the cervix.

3. The rectum may be invaded by a direct extension of the growth either through the cul-de-sac, the two surfaces of which have become adherent, or the posterior vaginal wall may become involved and the rectum secondarily invaded from the vagina, or in the lateral positions of the uterus the growth may extend across the obliterated cul-de-sac from the parametrium which lies in front of the rectum and which may have been invaded by the growth.

4. The first demand in the more radical operations for carcinoma is a wide excision of the primary growth, and portions of the rectal wall may be sacrificed and repaired if involved by the growth.

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3. ——— The Advantages of the Sims Posture in Cystoscopic Examinations. Johns Hopkins Hospital Bulletin, 1903, XIV, 194-196.

4. ——— Ascending Renal Infection; with Special Reference to the Reflux of Urine from the Bladder into the Ureters as an Etiological Factor in Its Causation and Maintenance. Johns Hopkins Hospital Bulletin, 1903, XIV, 334-352.

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OBSERVATIONS ON A STUDY OF THE SUBCLAVIAN ARTERY IN MAN.[1]

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The work on which these observations are based was undertaken at the suggestion of Dr. Harrison and carried out under the direction of Dr. Mall, in the anatomical laboratory of the Johns Hopkins University. The dissections were made by the students working in anatomy, and some of the drawings were made by them, but nearly all of the drawings were made by myself on Bardeen's Outline Record Charts.[2] One hundred and twenty-nine dissections of the subclavian artery were recorded, but fourteen of these were so incomplete as to be of no service in summarizing the work. Eighty per cent of the dissections were made on negro subjects. The artery was found to be divided naturally into five types, depending upon the origin of the large branches. The distribution of these branches was practically the same in all cases.

Type I was found in thirty per cent of the cases, and showed the internal mammary artery, rising from the first part of the subclavian, the vertebral rising from the first part of the subclavian, and the inferior thyroid and supra-scapular arteries rising from a common trunk which came off from the first part of the subclavian artery; also, the costo-cervical trunk arose from the second part of the subclavian artery, and so did the transverse cervical artery. This type was present on the right side of the body in twenty-two per cent of the subjects and on the left side of the body in eight per cent.

Type II was found in twenty-seven per cent of the cases, and showed the same origin for the vertebral and internal mammary arteries as Type I. The inferior thyroid, supra-scapular and transverse cervical arteries rose from a common trunk which came off from the first part of the subclavian artery. This is the thyroid axis as usually given. The costo-cervical trunk arose from the first part of the subclavian artery. This type of the artery was found on the left side of the body in twenty-two per cent of the subjects, and on the right side of the body in five per cent. In the three remaining types the vertebral and internal mammary arteries and the costo-cervical trunk arose from the first part of the subclavian artery as in Type II.

Type III was found in twenty-two per cent of the cases. In this type the inferior thyroid artery arose from the first part of the subclavian artery, the transverse cervical arose from the second part, and the supra-scapular from the third part. This was the most irregular of all the types. The supra-scapular artery arose from the axillary artery eight or nine times.

Type IV was found in twelve per cent of the cases. In this type the inferior thyroid artery arose from the first part of the subclavian artery. A trunk arose from the inferior thyroid artery and divided near the outer side of the neck into supra-scapular and transverse cervical arteries.

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[1] Abstract of a paper read before the Johns Hopkins Hospital Medical Society, March 21, 1904.

[2] A complete study of the subclavian artery will soon be published in the American Journal of Anatomy.

Type V was found in ten per cent of the cases. The inferior thyroid and transverse cervical arteries arose by a common trunk from the first part of the subclavian artery in this type. The supra-scapular artery arose from the internal mammary artery about two inches below the origin of the latter, and passed above the first rib, and anterior to the scalenus auticus muscle to its normal distribution. Arthur Thomson[3] tabulates five hundred and forty-four dissections of the subclavian artery. Classifying these in the same manner as our own cases, we get the five types with percentages as follows: Type I, forty-four per cent; Type II, forty-one per cent; Type III, seven per cent; Type IV, six and one-half per cent; Type V, one and one-half per cent.

Four anomalies were encountered frequently in the course of this work, and they are given in detail below because they may be important from a practical point of view. A "lateral thoracic artery" was found five times in twenty-eight subjects where the internal mammary artery was worked out in full. Many of the subjects were dissected after autopsies had been held, and in these the internal mammary artery had been destroyed, hence, the small number obtained. This "lateral thoracic artery" was as large as the internal mammary artery and arose from the latter beneath the first rib, and passed between the ribs and pleura to the diaphragm, sometimes ending about the fourth rib, and sending branches into each intercostal space, its distribution being similar to the internal mammary artery. This anomaly may be of interest clinically in cases of fractured ribs, in resection of ribs or in tapping the pleural cavity. From the position of this artery the indication would point to some posterior part of the thorax as the place of election for entering the pleural cavity with a trochar, rather than going in anteriorly about the sixth rib.

The second anomaly is Type V, which was found twelve times in one hundred and fifteen cases. Quain[4] found it present four times in two hundred and sixty-four cases (two per cent), and Arthur Thomson found it nine times in five hundred and forty-four cases (one and one-half per cent). This anomaly should be borne in mind when doing a complete breast operation, or in any operation near the sternal end of the clavicle, or the first rib.

The third anomaly is the middle thyroid artery or "arteria thyroida ima." This was found three times coming from the innominate artery, and, passing to the median line, it supplied the lower lobes of the thyroid gland and the isthmus. Wenzel Gruber[5] records one hundred and twenty-five anomalies of this kind, and concludes that the artery rises most frequently from the innominate artery, but also comes from the aorta and the common carotid artery not infrequently. He found it sixteen times in one hundred consecutive dissections. The anomaly should be considered in doing a tracheotomy, in operations on the thyroid gland, and in operations about the manubrium.

The fourth anomaly is the right subclavian artery coming from the distal part of the aortic arch, and passing between the œsophagus and the vertebral column at the third or fourth vertebra, finally going to its normal place above the first rib on the right side. Associated with this anomaly the two carotids arose together as the first branch of the aorta and the left subclavian arose as the second. Beyond this the right subclavian artery arose. The right recurrent laryngeal nerve did not form a loop around the subclavian artery, but passed directly to its normal distribution. This anomaly should have clinical consideration in relation to aneurism, especially with associated "dysphagia lusoria," or slow starvation, in diverticula of the œsophagus, carcinoma of the œsophagus, foreign bodies in the œsophagus, operations on the œsophagus, caries of the vertebræ (Potts' disease), scoliosis,[6] osteosarcoma of the vertebræ, heart disease (possible cause), small pulse on the right side, left-handedness ("causa anatomica"), operations on the thorax, ligations of arteries, and in bronchotomy in those rare instances in which the artery passes anterior to the trachea. The anomalous artery in its course fairly hugs the trachea and œsophagus, completely encircling them with an arterial band by crossing the right carotid artery just before passing over the first rib. This causes constriction of the trachea and œsophagus, with bulging of the two, on the one hand, and constriction of the right subclavian artery with dilatation of the latter, before it passes beyond the vertebræ, on the other. Gotthold Holzapfel[7] collected two hundred cases of this anomaly, including four of his own, and found dilatation of the artery in sixty-four per cent of the cases. Six of the cases had a funnel-shaped dilatation, and six showed a blind sac or pouch at the beginning of the artery, evidently aneurism. In the two cases found in the course of my work one was dilated, and in six other cases found in the literature besides the two hundred cases referred to above, one was reported to be dilated, no mention of dilatation being made in the other cases. Quain found this anomaly present four times in one thousand cases. Holzapfel considers it to be present six times in every thousand, while Tiedemann believed it occurred eight times per thousand. Holzapfel gives the following among many conclusions:

The anomaly is one of origin, of direction and of distribution; it arises about the second to fourth vertebra, also from the thoracic aorta lower down occasionally, and passes between the œsophagus and vertebral column (one hundred and seven times), seldom between the œsophagus and trachea (twenty times), and rarely in front of the trachea (six times); was found sixteen times in persons beyond the age of fifty years; occurs in normal and abnormal individuals (anatomically); the right recurrent laryngeal nerve goes directly to the trachea, without its normal loop; the thoracic duct is transposed to the right side at times; the pneumogastric and phrenic nerves are not influenced, and the large veins have their normal distribution; the anomaly does not cause left-handedness, and dysphagia comes only with aneurism. Three cases of "dysphagia lusoria" have been reported in connection with this anomaly: One by Bayford[8] in which a patient sixty-one years of age, who had been suffering with difficult deglutition throughout life, died from inability to swallow. Another by Autenrieth and Pfleiderer,[9] in which a woman about sixty years of age died of slow starvation. A third by Brewer[10] of simple dysphagia. All of these cases were associated with aneurism of the anomalous right subclavian artery at its origin. A case of erosion of the vertebræ and aorta was reported by Picard,[11] in which the aorta passed between the œsophagus and vertebræ. A case of sudden death from swallowing a large mouthful, resulting in rupture of this anomalous artery is reported by Kirby.[12]

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[3] Second Report of the Collective Investigation of the Anatomical Society of Great Britain and Ireland. Journal of Anatomy and Physiology, Vol. 26.

[4] Commentaries on the arteries, London, 1844.

[5] Virchow's Archiv., Vol. 54.

[6] Brent: The Lancet, 1844.

[7] Anatomische Hefte, 1897.

Three cases of heart disease associated with the anomaly have been reported, one by Walter,[13] in 1785; another by Froudsen,[14] in 1854, and a third by Schön,[15] in 1823.

Two cases of the anomaly in left-handed individuals were reported by Oehl.[16] Four cases have been reported in right-handed individuals.

Conclusions.

1. The subclavian artery may be arranged into five definite types according to the difference in origin of the large branches.

2. The artery differs on the two sides of the body, Type I being normal for the right side, and Type II for the left side.

3. Type I, without the thyroid axis as given in the anatomies of Quain and Gray, is the normal arrangement.

4. Type II, with the Thyroid axis is found fewer times than Type I.

5. Eighty per cent of the dissections were made in negro subjects, a large number of whom may have been mulattoes or mixed bloods. That hybrids tend toward variation is a well-known biological law. This may explain the large number of abnormalities encountered.

6. Four of the abnormalities are worthy of note: The lateral thoracic artery, Type V. The middle thyroid artery ("thryroidea ima"). The anomalous right subclavian artery.

7. These abnormalities may be of some clinical significance.

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[9] Reil's Archiv für die Physiologie, 1807.

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[14] Thesis: Arteriæ subclaviæ dextræ originis abnormis acdecursus Casus, Kiel, 1854.

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THE BLOOD IN PREGNANCY.

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From the time of Morgagni the constitution of the blood during pregnancy has been a subject of interest to many investigators and has given rise to a great deal of discussion, which unfortunately has not led to uniform conclusions, even in the hands of those working with modern methods.

Leaving out of consideration the old theories as to plethoric and chloranæmic conditions of the blood, the more recent work upon the subject may be roughly classified in three groups:

1. An undoubted diminution in the amount of hæmoglobin and the number of red cells (Couvert, Wicolks, Wiskeman, Fouassier, Kosina and Ekert, Ingerslev, Meyer, Dubner).

2. A diminution in the number of red corpuscles with a simultaneous increase in the amount of hæmoglobin (Cohnstein and Fehling).

3. No change (Korniloff, Ehrlich and Limbeck); while Reinl, Lebedeff and Schroeder hold that the constitution of the blood depends upon the general health of the individual, being poor in red cells and hæmoglobin where the patient is feeble, while it is unchanged in normal individuals.

With regard to the leucocytes. Since Moleschatt and Nasse, the fact that pregnancy leads to leucocytosis has been constantly observed and confirmed. (Paterson, Maurel, Isambert, Spiegelberg, Fouassier and Mallasez, Halla, Kosina, Ekert, Mochnatscheff, Limbeck, Rieder and others.) This was referred by some to a hypertrophy of the groups of lymphatic glands lying in the neighborhood of the genital apparatus, while others (Wyder, Leopold, Johnstone) referred it to the lymphoid tissue of the endometrium. Mochnatscheff distinguished further differences between the blood drawn from the finger-tip and that taken from the cervix, and explains this difference by a process of irritation of the womb whereby a leucocytosis takes place. He concludes that this undoubtedly causes the remarkable increase of colorless elements preceding delivery.

Rieder, who performed the largest series of observations, and who examined the condition of pregnant women after a fourteen to sixteen hours' fast, was able in only a small number of multiparæ to note a lack of increase in leucocytes; 21 out of 31 showing unmistakable leucocytosis. He is the only one of the observers who has studied in two cases the differential forms of leucocytes, as distinguished by Ehrlich, and whose figures agree with one another. He reckoned the average leucocytosis as 13,000, with a maximum figure of 16,500 and a minimum of 10,200. Others, as Mochnatscheff, place the maximum at 14,000.

Hahl concludes that during the last days of pregnancy the leucocytes are somewhat increased, that with the onset of labor pains a comparatively marked leucocytosis begins; this hyperleucocytosis (which is characterized by an increase of polymorphonuclear neutrophiles) is markedly diminished during labor, and usually during the first week of the puerperium a return to normal takes place.

Hubbard and White found a polymorphonuclear leucocytosis in 80 per cent of their 55 cases. Their averages 24 hours before labor were for primiparæ 15,000, for multiparæ 11,700.

As to the theories of a leucocytosis in pregnancy, Virchow referred it to a widening of the uterine and abdominal lymphatic vessels and nodes, and the increase of metabolism in the uterus and its contents. Limbeck supposes it to be due to changes in the breasts, viz.: the round-cell infiltration which many such glands show as an indication of a very active cellular process. Ewing concludes that "considering the behaviour of leucocytes in general, it is hardly surprising that the active cellular processes in breasts, uterus, vascular system and fœtus and the associated increase of metabolism should, when instituted for the first time, find a sympathetic excitement in the blood-producing organs."

With reference to the specific gravity of the blood, Nasse concludes from his observations on the blood obtained by venesection from 67 pregnant women that the decrease in specific gravity is not marked. Lloyd Jones confirmed these results, while he found in children and pregnant women the lowest figures and demonstrated a rise of specific gravity during the act of labor. While Lebedeff admits a falling off of blood gravity in pregnancy, Blumreich could establish no reason for it. According to Jones and Hammerschlag, who had proved a quite constant relationship between the decrease of specific gravity and that of the hæmoglobin and the count of red blood corpuscles, it must be concluded that corresponding to the drop in specific gravity, a diminution in red blood cells also takes place during pregnancy.

Zangemeister, who carried on observations upon women in the last two months of pregnancy, noted a diminution in specific gravity which he attributed to a loss in certain salts of the blood.

Among the most recent works on the subject of the blood in pregnancy is to be mentioned that of v. Rosthorn, who quotes the results of Payer with the conclusion that the blood of pregnancy has a normal number of red blood corpuscles, normal hæmoglobin, moderate leucocytosis, somewhat lessened native alkalinity, and normal molecular concentration. Pray finds a diminution of 80,000 red cells, with an increase of hæmoglobin and a hyperleucocytosis.

Observations.

In view of the unsettled state of this question, and in an endeavor to clear away some of the doubtful points concerning the blood state of pregnancy, we began observations on the blood of pregnant women in the Obstetrical Department of Johns Hopkins Hospital under the auspices of Dr. J. Whitridge Williams, to whom we wish to express our thanks for extending to us the courtesies of his department and for his many helpful suggestions and lively interest in this work.

The series includes 12 cases (11 colored and 1 white patient). The women were all of the poorer class, but are living under practically the same hygienic and dietary conditions, suffering from no constitutional disease and having no special pathological affections.

The observations cover a period of seven months, from October, 1903, to May, 1904. Each patient was examined once a month from the time she was first seen until the present date. Two of the cases first came under observation at the second month of pregnancy; two at the third month; four at the fourth month; three at the fifth; while the remaining case was not seen until the sixth month.

Four of the cases have been followed throughout their pregnancy and subsequent delivery, while the other eight are still under observation.

The monthly blood examination of each case includes (1) enumeration of red blood corpuscles, (2) estimation of hæmoglobin percentage, (3) count of leucocytes, (4) differentiation of leucocytes, and (5) determination of specific gravity of the total blood content.

The series comprises 33 separate blood examinations, each examination including 5 parts, or a total of 165 various estimations, whose results are as follows:

(1.) Red Blood Corpuscles.

The blood drop was in each case taken from the lobe of the ear, the Thoma-Zeiss instrument was employed and the blood diluted 200 times with Toison's solution. Out of a total of 33 cases, the average count in the—

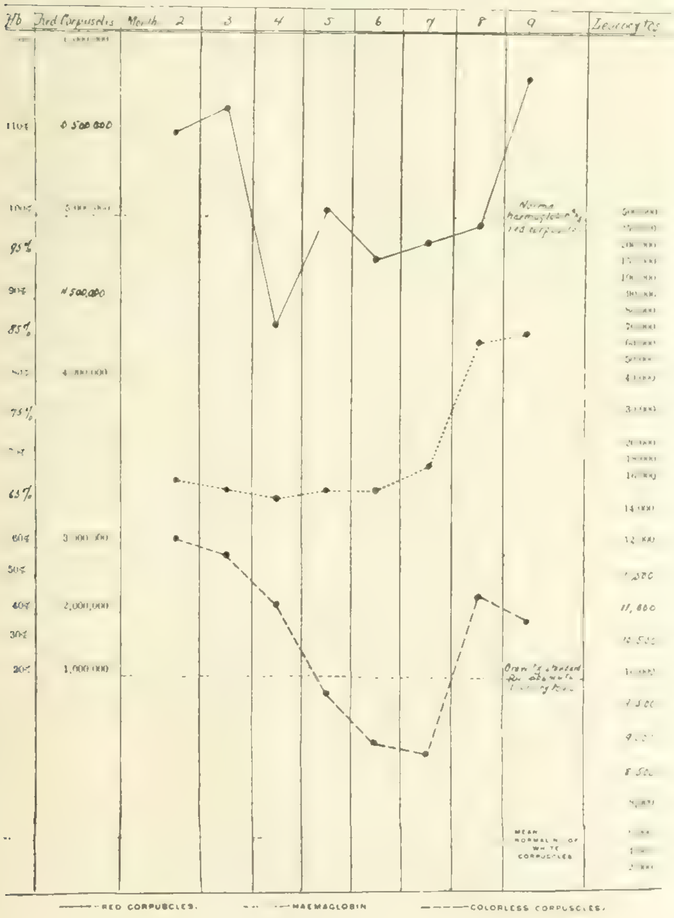
2nd month equalled 5,500,000 red blood cells.
3rd " " 5,600,000 " " "
4th " " 4,300,000 " " "
5th " " 5,000,000 " " "
6th " " 4,600,000 " " "
7th " " 4,700,000 " " "
8th " " 4,900,000 " " "
9th " " 5,800,000 " " "

The following table gives the figures in detail for each month from the 2nd to the 9th inclusive:

Cases.	2d mo.	3	4	5	6	7	8	9
No. 1	5,508,000	....	4,716,000	....	....	4,620,000	....	
2	....		3,480,000	3,864,000	4,064,000	4,888,000	4,440,000	.
3	...	...	4,480,000	5,480,000	5,048,000	5,592,000	4,932,000	
4	....	....	....	4,900,000	4,488,000	3,948,000	....	. .
5	...	. . ..	....	4,876,000	5,156,000	4,604,000	5,616,000	5,876,000
6	5,520,000	5,208,000	....	....	....	....	....	..
7	....	4,628,000	4,800,000	5,384,000	...	....	....	. .
8	....	7,008,000	5,464,000	...	...	....	....	....
9	....	....	....	4,644,000	4,948,000	....	....	. .
10	....	....	5,164,000	...	....	....	....	....
11	..	4,068,000	....	....	....	....	....	....
12	....	4,540,000	....	....	. ..	....	....	...
Averages:	**5,514,000**	**5,614,666**	**4,347,333**	**5,018,857**	**4,680,000**	**4,766,666**	**4,996,000**	**5,876,000**

It is clear that in our series the count is high at the extremes of pregnancy (5,500,000 at the second and third months and 5,800,000 at the ninth month) while it is somewhat lower in the intermediate periods—4th to 8th months inclusive—dropping to 4,300,000 at the 4th month, then rising irregularly to reach 5,800,000 at the ninth month. It will be seen from the average curve (Chart I) that this drop after the beginning of pregnancy with a low intermediate value and an irregular rise as labor comes on, is quite well marked. By reference to the above table of figures it will be seen that cases No. 1, 4, 6 and 8 show the initial drop, while case No. 5 shows the terminal rise in red blood corpuscles.

CHART I.



(2.) Hæmoglobin.

As in the case of the red cells, the drop was drawn from the ear and the computation made with Gowers' apparatus, which was standardized against a new Miescher instrument, the two instruments recording the same. The figures obtained (percentages) are shown in detail in the following table:

Cases.	2d mo.	3	4	5	6	7	8	9
No. 1	70	..	65	..	..	55	..	..
2	..	..	55	55	65	70	72	..
3	..	..	80	83	80	80	90	..
4	..	..	..	60	60	65	..	..
5	..	..	..	70	65	60	90	85
6	65	65	..	..	..	..	..	..
7	..	60	65	..	..	82	..	..
8	..	75	..	60	..	..	..	..
9	.	.	..	..	60	70	..	..
10	..	..	..	70	..	..	..	..
11	..	..	70	..	..	..	..	..
12	..	..	55	..	.	..	..	..
Averages:	67.5	66.7	65	66.3	66	68.8	84	85

The hæmoglobin, therefore, as early as the 2nd month of pregnancy is low, continues at this level (65 to 67 per cent) until the 7th month, when it begins to increase, until at the 8th and 9th months it has risen to 85 per cent—a gain of nearly 20 per cent.

(3.) Leucocytes.

Cases.	2d mo.	3	4	5	6	7	8	9
No. 1	11,650	..	11,200	..	..	10,640	..	..
2	..	..	11,250	10,050	9,960	9,150	13,250	..
3	..	..	10,950	11,080	9,250	8,400	13,200	..
4	..	..	..	8,550	5,480	7,600	..	..
5	..	..	..	8,950	10,000	7,666	7,050	10,750
6	12,600	12,700	..	..	..	..	..	..
7	..	11,000	11,100	..	..	9,100	..	.
8	..	..	..	8,132	..	..	..	..
9	..	..	..	..	9,500	..	..	..
10	..	..	..	11,400	..	..	..	..
11	..	..	11,500	..	..	..	..	..
12	..	..	10,200	..	..	..	..	..
Averages:	12,125	11,850	11,033	9,693	8,838	8,759	11,166	10,750

For determining the leucocytes, a blood drop was taken from the lobe of the ear, avoiding pressure, diluted 20 times with Toison's solution, and the leucocytes counted with the Thoma-Zeiss apparatus.

As is seen by the table, in only one of the 33 counts were the leucocytes below 7,000. The minimum was 5,400, the maximum 12,700, while the average was about 9,000.

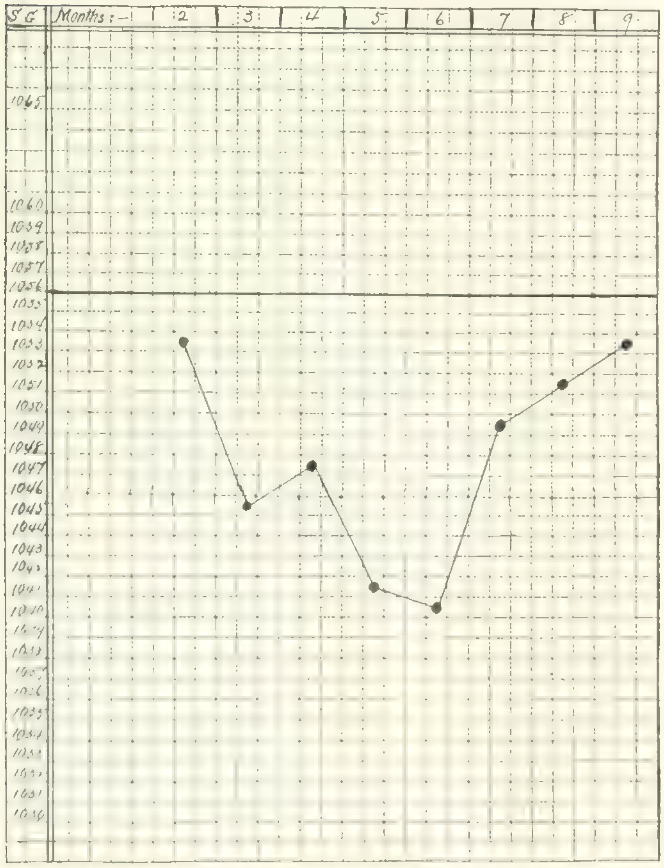
In only the one case did the leucocytes reach the normal mean standard of 5,500, while most of the cases had a leucocytosis of 10,000 to 12,000. A leucocytosis in any given case is always relative, not to a fixed standard, but to that individual in health. Now, if we take 5,500 as the mean normal number of leucocytes, it will be seen, by referring to the above table, that, not only do *all* our cases present a leucocytosis *relative* to the average woman, but, with Grawitz' standard of 10,000 as the criterion, the majority of them, in the different months of pregnancy, show a *slight absolute leucocytosis.*

(4.) Differential Count of Leucocytes.

Smears were prepared by allowing a small drop of blood to fall upon a cover slip which was brought in contact with another slip, the two being then drawn rapidly apart and the thin smear of blood dried in the air. They were then stained with Wright's modification of Leischmann's stain. Thirteen differential counts were then made, and in each instance 500 cells were studied, the results being given in the following table:

Cases.	Polymorphonuclear neutrophiles.	Small mononuclears	Large mononuclears	Eosinophiles.
No. 1	364	85	48	3
2	419	51	23	4
3	387	88	22	3
4	426	47	26	1
5	343	103	53	1
6	410	49	20	20
7	357	110	33	0
8	380	92	38	15
9	397	85	17	1
10	300	147	53	0
11	310	138	46	6
12	367	83	45	5
13	372	96	28	4
Averages	371	90	34	5
Percentages	74.2%	18%	6.8%	1%

CHART II.



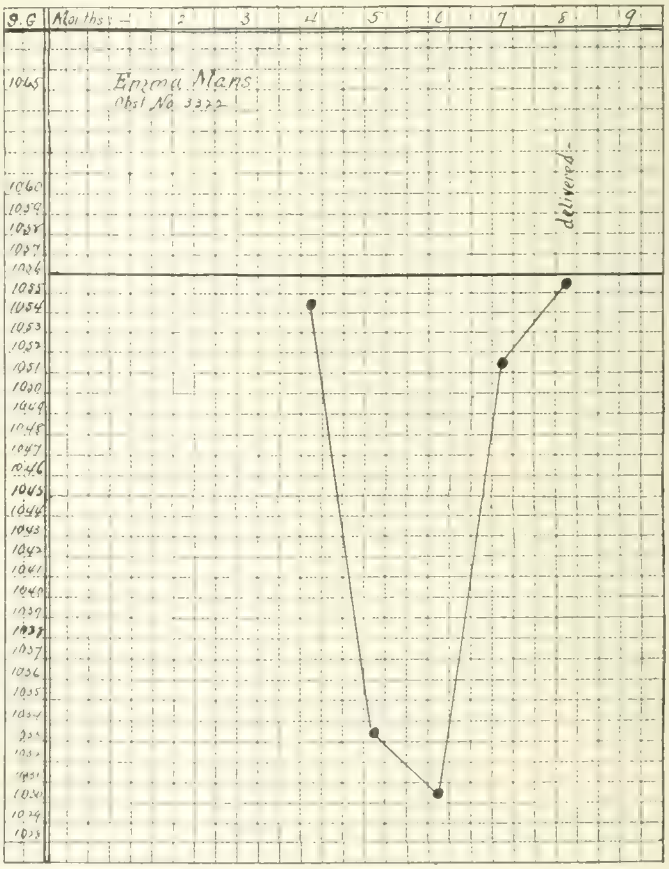
These results show an increase of 2 per cent in polynuclears and about the same in large mononuclears, while the small mononuclears are diminished about 5 per cent and the eosinophiles about 2 per cent from the accepted standard for these cells, but practically the differential count is normal.

(5.) Specific Gravity.

The specific gravity was determined in 33 estimations. The gravity of the total blood content (not of its serum) was obtained. We followed the method of Hammerschlag, using the benzol-chloroform mixture, and obtained the following figures for the several months:

Cases.	2d mo.	3	4	5	6	7	8	9
No. 1	1057	..	1043	..	..	1047	..	..
2	..	..	1054	1033	1030	1051	1055	..
3	..	..	1057	1049	1042	1047	1050	..
4	..	..	..	1048	1043	1046	..	..
5	.	..	.	1042	1039	1042	1050	1053
6	1050	1051	..	..	..	..	..	..
7	..	1032	1035	..	..	1052	..	..
8	..	1052	..	1045	..	..	..	..
9	..	..	..	..	1050	1058	..	..
10	..	..	..	1032	..	..	..	..
11	..	..	1050	..	..	..	..	..
12	..	..	1046	..	..	..	..	..
Averages:	1053.5	1045	1047.5	1041.5	1040.8	1049	1051.6	1053

CHART III.



As will be seen from the above figures, the specific gravity is, as a rule, high in the early months of pregnancy, diminishes progressively in the ensuing months, to again rise to nearly normal at the termination of the gravid state. In some cases the specific gravity decreases intermittently; in others (Chart III, Case No. 3322) the decrease is regular, while in all cases the gravity is subnormal. The initial fall and terminal rise can be traced in every case.

If we take the average specific gravity of all the cases for each month, and plot a curve (Chart II), or if each case be examined by itself, the curve will be found the same in either instance—high at the beginning and end of pregnancy, low in the intermediate months.

Nasse, in 1853, pointed out that the blood gravity decreases rather early in pregnancy and rises somewhat at its termination, but he did not demonstrate any regularity in this respect, indeed he stated that the decrease is not marked.

Jones and Hammerschlag conclude that corresponding to the drop in specific gravity, a diminution in red blood cells also takes place during pregnancy. This corresponds with the results of our observations, as will be seen by referring to Chart I, where the curve of red blood corpuscles is shown.

Water enters so largely into the composition of the blood, and as it is, moreover, the most variable constituent, we should expect alterations of the blood gravity under ordinary conditions to be due largely to this factor.

The proportion of salts, on the other hand, is small, less variable, and hence less likely to effect any marked alteration in the specific gravity. Zangemeister, however, refers the low specific gravity to a loss of certain salts.

The albumens of the blood are the last principle to be affected by alterations of metabolism, and, as Ewing remarks, "when the albumens of the blood are affected, marked and permanent changes result in its specific gravity."

That marked and permanent changes do occur in the specific gravity of the blood and that corresponding to this drop a decrease in red blood cells also takes place in pregnancy has been repeatedly demonstrated in our observations. It is possible that the reduction in specific gravity during pregnancy may be due to a decrease in the albuminous elements of the red blood cells.

Dieballa showed that a diminution of 10 per cent hæmoglobin corresponds to a drop of 4.46 p. m. specific gravity. Now, if the drop in hæmoglobin was proportional to the fall in specific gravity, we might attribute the latter to the former, since, as is well known, the determination of specific gravity is a well-recognized method of determining the hæmoglobin.

Our results, however, tend to show that the hæmoglobin is proportionately higher than the specific gravity of the total blood content (as in Case 3322 shown in Chart III), the drop in hæmoglobin being only 20, while the drop in specific gravity was 24. It is evident, therefore, that the drop in specific gravity is not due to the drop in hæmoglobin.

Slemons, in a recent contribution, has shown that the organism, under the influence of pregnancy, stores much more water than at other times, and, moreover, that, preceding labor, a marked diuresis occurs.

In view of Slemons' findings, we are inclined to believe that the low specific gravity of the blood in pregnancy is due to an admixture of water in the plasma—a serous dilution or hydræmia, and that the terminal rise in specific gravity as labor approaches may possibly be due to the marked diuresis which occurs at that time.

CONCLUSIONS.

1. A moderate decrease is observed in red blood corpuscles rather early in pregnancy, remaining subnormal throughout the middle months, to rise again to normal at the termination of pregnancy—not, however, in all cases.

2. A low percentage of hæmoglobin, constant throughout the first seven months, rapidly approaching normal as pregnancy draws to a close.

3. A slight absolute leucocytosis exists in every case of pregnancy, but this slight leucocytosis does not support the theory that it is due to any positive chemio-taxis.

4. There is no variation from normal in the different forms of colorless corpuscles, the leucocytosis affecting all forms of white cells alike.

5. The specific gravity is high at the onset of pregnancy, diminishing by progressive steps, to reach its lowest level in the middle months, rising to normal at term.

A CASE OF GENERALIZED LEAD PARALYSIS, WITH A REVIEW OF THE CASES OF LEAD PALSY SEEN IN THE HOSPITAL.

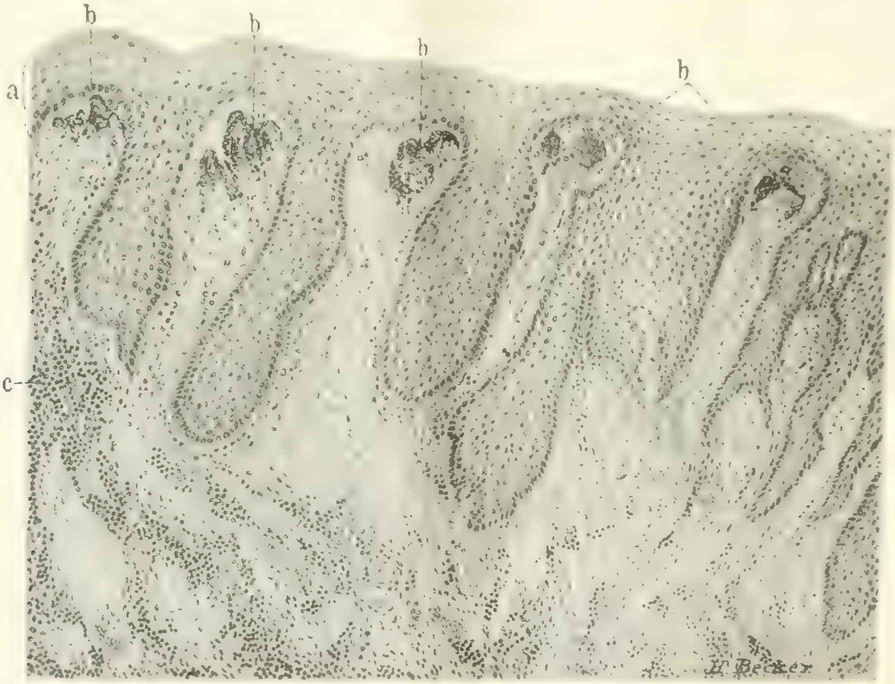
By HENRY M. THOMAS, M. D.,

Clinical Professor of Neurology, Johns Hopkins University.

This patient, from Dr. Osler's ward, has interested us very much, because his condition is one of great rarity and because we have seen no exactly similar case. The patient was admitted Nov. 3, 1903. He is a man of 46, and has been at work as an enameller. The process employed in the factory in which he worked is a secret one, but it is quite certain that the material used contains a great deal of lead. There is nothing else of importance in either his family or personal history, except in relation to his use of alcohol. He has been a heavy drinker, taking several glasses of beer a day, as well as more or less whiskey, and on Saturday nights, when he had the money, he was in the habit of drinking much more, usually going to bed drunk.

He had formerly worked as a stevedore, but last summer became an enamel worker. After working at this new occupation for only two weeks, he noticed that he was becoming weak. This weakness showed itself first in his legs, but it increased and spread so rapidly over his body that in a little more than a week he had become bed-ridden and helpless. He gives no history of having had any pain in his stomach or sharp pain in his legs or arms, but certain of the joints have been painful. His mother told us that soon after he took to his bed he was for several days somewhat delirious. The patient was admitted to the hospital about two months after he had become paralyzed. Since then he has shown no sign of mental disturbance.

As you see, the patient is a pale, sick-looking man. His blood count gives red blood corpuscles 3,736,000, white blood corpuscles 3,100, hæmoglobin 40 per cent. After repeated examinations, granular degeneration of the red blood cells was demonstrated. There is a typical lead line on his gums, and under the microscope Dr. Stevens has placed a section of a bit of the gum which shows very well that the black sulphide of lead is deposited in the substance of the tissue itself (see illustration).



There is no involvement of any of the cranial nerves and an ophthalmoscopic examination showed the fundus to be normal. The muscles of his neck are fairly strong but below these nearly every muscle is completely paralyzed. There is slight power in the pectoral muscle, but nowhere else in the shoulder-girdle or arms. You will notice that his respiration is entirely thoracic, the diaphragm being completely inactive. The muscles of the trunk are also affected and in the legs the only motions that are left are slight flexion at the hip and feeble movements of the toes. The reaction of degeneration to the electrical currents is present in the paralyzed muscles. The deep reflexes are all lost. Sensation is everywhere acute. Firm pressure over the various muscle groups in the arms and legs causes pain. The right shoulder joint is somewhat swollen and painful. There is no disturbance in either the bladder or rectum.

The picture which he presents is a very typical one of a severe multiple neuritis, but the interesting point is that this is apparently due to an intense intoxication by lead. The trouble came on a man (who, to be sure, has a strong alcoholic history) two weeks after he began to work in lead, and who now shows the evidence of lead poisoning, the lead line and a granular degeneration of the red blood corpuscles. The paralysis has not the distribution that is typical of lead, but similar cases have been described by several authors under the title of "Generalized Lead Paralysis."

Note.—April 15, 1904. The patient has improved slowly and has recovered a considerable amount of power in the muscles about the shoulder-girdle and the hip-joint. His anæmia has decreased. There is considerable atrophy of the muscles.

I have examined the records of the hospital and the neurological dispensary and have found that 33 cases of lead poisoning have been admitted to the medical wards and 25 have been treated in the nervous dispensary. Four of these 58 cases were seen in both departments and we have therefore the histories of 54 patients. As would be expected, the cases entering the hospital are of very different character from those seen in the out-patient department. In the neurological dispensary we meet only with cases showing definite nervous symptoms, and see none of the cases suffering from the more common effects of lead poisoning, constipation, colic, etc., these cases being referred to the medical dispensary. The patients admitted to the wards are usually those who show the more intense form of gastro-intestinal disturbances, or have evidence of grave intoxication. Of the 33 hospital cases, there was no complaint of muscular weakness in 23; in 6 of these, however, some slight muscular involvement was discovered on examination, and in one case, complicated with heart disease, a hemiplegia developed while in the hospital. In 10 cases there was definite motor paralysis.

Of these 10 hospital cases showing paralysis, 5 exhibited the usual form of lead paralysis, viz.: double wrist-drop. In one case the wrist-drop was confined to the right side; in the four remaining cases both the arms and legs were more or less severely affected.

Of the 25 cases treated in the neurological dispensary, 23 of them complained of paralysis. Fifteen of these showed bilateral wrist-drop, 6 paralysis confined to the right arm, and in one it was confined to the left arm. In one case the paralysis was confined to the leg, in the distribution of the right external popliteal nerve; this last, however, is a doubtful case, as the paralysis developed in a painter after a long day's work in a squatting position, and the nerve may have been injured by pressure.

If we combine the records of the hospital and dispensary cases, deducting the duplicate cases, we have 31 cases of lead paralysis. Eighteen of these showed the typical distribution of paralysis in the form of double wrist-drop. In 7 the weakness was confined to the right arm and in one to the left, *i. e.,* the paralysis was confined to the arms in 26 cases. The arms and legs were involved together in 4 cases. The remaining case, in which the right leg alone was affected, I think should be excluded.

We are particularly interested to-night in these four cases in which the paralysis affected the legs as well as the arms.

Case I (No. 2293) was that of a girl, five and a half years old, who was in the habit of eating the remains of food left in tin cans, and who had had weakness of her arms for three months. Two days before admission her legs became so weak that she was entirely unable to walk. There was a lead line on the gums; knee jerks were normal. She remained in the wards only two days. It is worthy of note that this is the only case of suspected lead poisoning that we have had in a child, and it agrees with the statement of some authors that in children the legs are particularly apt to be affected.

Case II (No. 2617), a tinner, 42 years old, was admitted on account of paralysis of his legs, which had come on suddenly eight days before. There was marked weakness of his legs and to a less extent of his arms. Deep reflexes were absent. No lead line was discovered, and there seems to have been loss of control of his rectum, which facts throw doubt upon the diagnosis.

Case III (No. 11,733) was a painter, 43 years old, with a history of many attacks of colic and weakness of his arms for several years. He was admitted on account of pains in his arms and legs. There was definite, although not great, loss of power in the muscles of his legs, as well as in his arms. His knee jerks were exaggerated; there was a distinct lead line.

Case IV (No. 13.757) is of particular interest, as it shows an intense degree of intoxication. The patient was a man, 28 years old, an enameller by trade, as is the patient now before you, and had worked in lead for eight years. He came to the neurological dispensary with the history that two months before he had had an attack of unconsciousness and that six weeks after this had begun to suffer from headache and weakness of wrists. He then developed pain in his knees. He kept on working for a week, his wrists becoming weaker and his legs becoming numb and weak. He then had severe colicky pains in his stomach and began to vomit. This persisting, he entered the hospital on the second day. He was evidently very weak and ill and was at once sent to the wards. There was a general weakness of arms and legs with well-marked wrist- and ankle-drop. Deep reflexes were not obtained in arms and were present but not exaggerated in legs. Sensation was normal. The lead line was present. There was no change in the fundus oculi. On the evening of the day of his admission to the hospital he became delirious, imagining spirits were after him. The next morning he was perfectly rational but again became delirious in the evening of the fourth day, and was more or less unconscious from that time on. On this day he developed fever and in a day or two meningitis was suspected. Lumbar puncture did not confirm this and it was soon evident that he had pneumonia. He died 19 days after entering the hospital. The blood was examined on two occasions but no granular degeneration of the red blood cells was found. Broncho-pneumonia and chronic tuberculosis were found at autopsy.

Of these four cases, the second should not have been included, since, other than his occupation, there is nothing that speaks for lead as being the cause of his paralysis; and we therefore have, with the case you have just seen, four patients in whom the legs were more or less affected. The paralysis in the other three had not this widespread distribution and this is the only case that deserves to be classed as *acute generalized lead paralysis.* Similar cases have been described by Mme. Dejerine-Klumpke, E. Remak and others. The involvement of the diaphragm, which is so beautifully shown in this patient, makes the case a serious one and we dread for him an extension of the paralysis to the intercostal muscles or any intercurrent respiratory infection, as we fear he would be unable to withstand a further interference with his respiration.

You may have noticed that the enameller who died in the hospital showed marked mental symptoms before the development of his terminal pneumonia. He was delirious and difficult to control on two different nights, but quite rational on the following mornings. The patient before you to-night is said to have been delirious at the onset of his trouble. Three of the other hospital patients also showed marked cerebral involvement. Thus, a patient (No. 5608) was admitted with tremor of hands and subjective feelings of weakness of arms and legs. There was a lead line on the gums. He gives the history of having been subject to attacks of vertigo and of having had two attacks of unconsciousness While under treatment he developed delusions of persecution with maniacal excitement and had to be removed to the insane wards at Bay View. In this case there was also a history of alcohol and syphilis. Still more interesting was the case of a carriage painter (No. 13,677), who came in suffering from a severe attack of lead colic. He had had five previous attacks. There was no paralysis but a definite lead line was present and the red blood cells showed the typical granular degeneration. On the second day of his stay in the hospital he became delirious and then unconscious for a short time. Upon regaining consciousness he seemed rational, but complained that he was completely blind. No changes could be seen in his eye-grounds and he regained his sight in half an hour. Two days after this he had another attack of unconsciousness but without visual disturbances. His recovery was rapid and he soon left the hospital. He was readmitted the next year with another attack of colic, with which, however, there were no cerebral symptoms.

Another painter (No. 14,101), with colic and double wrist-drop, who showed a marked lead line and granular degeneration in the blood, was more than once delirious during the night, while in the wards.

Among the dispensary histories of patients who were not admitted to the hospital I find the mention of cerebral symptoms twice. In one case it was delirium during the night in a stereotyper with double wrist-drop, and in another it was an attack of unconsciousness and convulsions in a lad of 18, who had gotten his poisoning while working as a brass finisher.

These patients illustrate the fact that lead at times exerts its poisonous effects on the brain. This has been well recognized ever since Tanquerel's fundamental monograph in 1838. He classes such cases under the term "Lead encephalopathy."

The experience in this hospital in regard to the source from which the poisoning was derived differs very little from that of others. More than half of the patients (28) worked with paints containing lead. The other group is made up of workers in various other trades in which lead is more or less used (brass workers, 4; enamellers, 3; can-makers, 3; tinners, 2; stereotypers, 1; glass-cutters (putty), 1 etc.), and of those who had taken the poison as medicine or in food. Four patients had slight lead poisoning after taking lead and opium medicinally for a considerable time; one was severely affected from drinking home-made wine, which had been kept in a cask fitted with a lead pipe, and the little girl who was so severely paralyzed got the lead, we thought, by eating the scrapings of food which remained in cans. In four cases we were unable to determine any probable source for the lead.

NOTES ON NEW BOOKS.

The Self-Cure of Consumption without Medicine. By Chas. H. Stanley Davis, M. D., Ph. D. (*New York: E. B. Treat & Co., 1904.*)

The central idea of this little book, namely, that the cure of consumption is largely in the hands of the patient himself, is one of great importance, since the cure of tuberculosis is, as the writer remarks, "the most important economic problem that confronts the American people." Its relief, in his opinion, is much less dependent on climatic surroundings than has hitherto been supposed; they are, indeed, but one factor, and can never act beneficially in the absence of hygenic conditions. To secure such conditions, especially in respect to food and exercise, is the great object towards which effort should be directed, and residence in a sanatorium is essential to its accomplishment in a large number of cases. For, although the necessary regulation of life is largely within the patient's own hands, it is only the exceptional patient who can be trusted to carry them out in their integrity. The description of the methods employed in different sanatoria are interesting, and afford much useful information for those who require it.

The chapter devoted to showing the uselessness of almost all drugs in the treatment of consumption is prudently and carefully written. As a whole, the book contains all that is essential for the information of the public mind on the subject, put with clearness and common sense, and it is, therefore, a work of value, for the education of the public is the one means by which consumption can ever be eradicated, and everything which contributes to this end deserves respect and consideration.

The Blues (Splanchnic Neurasthenia); Causes and Cure. By Albert Abrams, A. M., M. D., Heidelberg, F. R. M. S. (*New York: E. B. Treat & Co., 1904.*)

The object of this little book is to focus attention upon a special form of nervous exhaustion, characterized by extreme depression, which arises from congestion of the abdominal veins affecting in turn the splanchnic nerves. The writer presents his theory with much elaboration, but the clinical evidence which he brings to support it is inadequate for the purpose. Nevertheless, there can be no doubt that too little attention is paid as yet to the influence of the splanchnic nerves in the human economy and the book deserves attention from a suggestive point of view, since it is more than possible that further investigation along the lines which it follows, will repay effort.

Manual of Clinical Microscopy and Chemistry. By Dr. Hermann Lenhartz; authorized translation from the fourth and last German edition by Henry T. Brooks, M. D. (*Philadelphia: F. A. Davis Company, 1904.*)

In the preface to the first edition of his book the author states that it has been his endeavor to present a work which shall not only instruct in chemical microscopy and chemical methods of examination, but aid in interpreting their diagnostic significance. He is to be congratulated on his success in both respects, but particularly in the second. Practical utility is the book's most striking characteristic, and English speaking, or rather English reading people are fortunate in having access to it through the medium of a good translator. The author has shown good judgment in devoting special attention to the chemical side of the book, for the constantly increasing importance of this side of clinical diagnosis makes its development especially valuable, and in this connection the section on examination of urine deserves particular notice. The book contains a large number of excellent illustrations, and its value is enhanced by a full and accurate index, which in any manual is indispensable to real service.

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THE SENSORY DISTRIBUTION OF THE FIFTH CRANIAL NERVE.

BY HARVEY CUSHING, M. D.,

Associate Professor of Surgery, the Johns Hopkins University.

There are several ways in which the confines of the trigeminal sensory field may be more or less accurately determined.

First of all, morphological studies serve to indicate what the boundary is likely to be, inasmuch as the structures that develop cephalad to the first visceral cleft will, in the natural order of things, receive their sensory supply solely from the N. trigeminus.

In the second place, anatomical dissections furnish possibly the most simple and commonly utilized means of establishing the destination of the finer ramifications of this as of any other nerve whose main radicle enters into no plexiform relations with its neighbors.

A third method is the experimental one in which comparative observations in the lower animals are made upon the functional, rather than the anatomical field of distribution; either by section of the nerve in question and determination of the resultant field of "no response" to sensory stimuli, or else by section of the adjoining roots leaving intact the sensativity of the area to be demarcated. Thus a negative as well as a positive field may be surveyed and the physiological overlap from one side or the other be determined.

There remain, finally and fourthly, the opportunities which are offered by the study of clinical cases. The various conditions encountered at the bedside may be conveniently divided into two groups. One of these, the more objective, presents a visible peripheral lesion resultant upon pathological changes of one sort or another in the posterior root ganglia; the other partakes of the principles involved in the preceding paragraph, the opportunity being grasped of outlining the area of disturbed sensation when, from disease, accident or intent, the continuity of the nerve or of its neighbors has been severed.

In this paper, as was the case in the studies which led to it, the subject will be approached primarily from the standpoint of this fourth method and the relationship to the clinical findings which are borne by observations made after one or another of the first three methods will be discussed secondarily.

1. Results of Clinical Observations.

Of those clinical states bearing an apparent relation to the partial loss of trigeminal control and all of which presumably indicate disturbances situate in the ganglion, congenital nævi, progressive hemifacial atrophy and herpes zoster alone need be mentioned as giving characteristic objective lesions that conform more or less closely in distribution with one or another division of the familiar trigeminal skin-field. Even zoster, however, far the most definite of these states, indicates territorial outlines very roughly at best and valuable as has been the evidence that studies of herpetic eruptions have given in regard to segmental topography, accurate delineation of segmental boundaries is not looked for from data furnished by these cases. The same may be said of some states of a purely subjective nature which similarly are useful and interesting rather as furnishing confirmation of the outlines determined in other ways, than as adding anything more to their definiteness. For example, intra-cranial disturbances may at times, by reflex action through the trigeminus, give pain with hyperæsthesia and tenderness over the entire field of sensory distribution of the nerve. I have twice seen patients suffering from the effects of a small extradural abscess of otitic origin in whom it was possible to clearly delineate the trigeminal outline including its auricular portion, by this hypersensitiveness to tactual impressions, though it may be doubted whether the accuracy of the outline would have been recognized without a thorough preliminary acquaintance with the normal boundary. The same statement applies to those cases of severe major neuralgia in which the entire sensory field of the fifth may be included in the paroxysmal wave of pain.

Instances of traumatism, or of progressive involvement of the nerve in morbid processes in such wise as to interrupt afferent impulses, have supplied, heretofore, the chief opportunities of determining in man the function and distribution of the trigeminus. It would be unusual for a single observer to have for a study a considerable series of such cases and the lesions, unfortunately, are rarely uncomplicated, sufficiently circumscribed, or if so, possible to authenticate by a post-mortem examination and intracranial lesions of any seriousness are too apt to leave patients in a condition in which it is difficult to properly carry out delicate sensory examinations. It is, possibly, for this reason, rather than because of the supposed great variability in outline of the trigeminal field, that one finds in standard text-books of medicine and neurology so great a lack of unanimity in the described and pictured boundaries of this area.

Needless to say, no clinical condition offers opportunities so favorable for subsequent study of the function of the fifth nerve as that supplied by a purposeful intracranial neurectomy. In no other way is it possible to obtain for study an uncomplicated group of cases presenting this simple lesion alone and from which may be gathered the average normal distribution as well as its variations. It is often said that the conditions are comparable to those of an accurate physiological experiment, but they are much more than that. The stumbling block of the laboratory in studies of sensory nerve distribution has been not only the great difficulty of eliciting responses but of interpreting the animal's sensations, a matter so subjective that verbal communication is necessary. This is possible only between man and man, and even here a mind more acute than the ordinary on the part of the subject is desirable since only by the observer's interpretation of the patient's own comment upon his sensations, for which any one has but a small vocabulary, can data of great reliability be obtained. Little has been added to our knowledge of the consequences of this operation from an anatomical and physiological point of view since the publication in 1896 of Krause's well-known monograph.[1] Six of the cases which at that time formed the basis of his studies were therein reported with especial care from the standpoint of the post-operative sensory disturbances and his findings will be commented upon later on. Most of the surgeons, other than Krause, who have had a series of these cases sufficient to furnish material for similar observations, have devoted their reports more to the operative aspect of ganglion extirpation than to the study of its physiological consequences.[2] The observations are, unfortunately, time-consuming and tedious, and only a spirit of investigation would provoke their study. They are, furthermore, as fatiguing to the patient as to the observer, and it is necessary to have the absolute co-operation of the former and the willingness of both to sacrifice time. Happily, those individuals who have been released from the indescribable sufferings of extreme forms of neuralgia quniti major are willing enough to lend themselves to the annoyance and tedium of sensory tests, and happily again, convalescence, as a rule, is so rapid from this operation that observations may be profitably begun on the succeeding day and be corroborated or added to by frequent examinations during the period of hospital residence.

The series of cases of ganglion extirpation or of division of the trigeminal sensory root from which have been obtained the results to be given in this paper are twenty-six in number. Of these, a few of the earlier cases are comparatively of little value, for although the extirpation in the majority of them was total, the anæsthetic areas, as the records and the photographs show, were very casually mapped out, and usually to one form of sensation alone. Subsequent examinations in some of these cases, even after three or four years, have revealed outlines which indicate the crudeness of the earlier delineations. In all of the later cases great pains have been taken to carefully trace the boundary lines of anæsthesia to all forms of sensation, and, as will be seen, with the result of determining a definite outline from which in the great majority of cases there is only the very slightest individual deviation. Several of the cases, furthermore, had had no preliminary neurectomies of peripheral nerves so that possible functional overlapping on long-standing patches of anæsthesia was the source of no confusion during the early tests.

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[1] Fedor Krause: Die Neuralgie des Trigeminus nebst der Anatomie und Physiologie des Nerven. Leipzig. F. C. W. Vogel, 1896.

[2] Frequently diagrams or photographs accompany the reports of these operations, showing the resultant area of anæsthesia without comment upon the method of testing the same. From the configuration of the area which is usually delineated in those cases, in which a total extirpation has been assured, one would judge that it represented the outline of total analgesia as it would be conveniently mapped out by a pin or needle

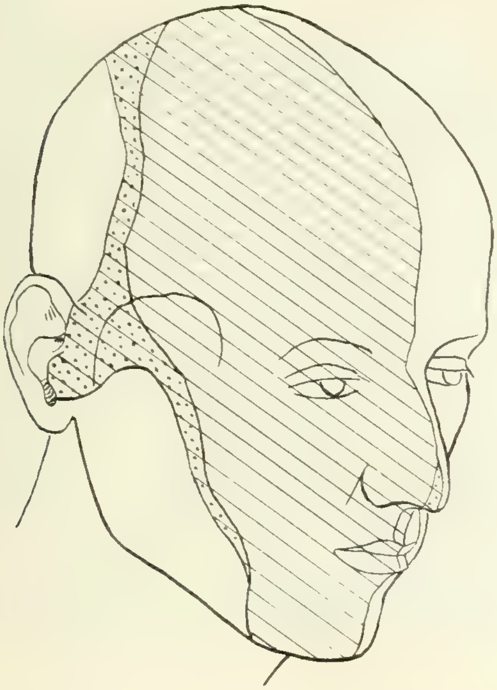

Fig. 1.—Diagram showing the normal (average) field of post-operative cutaneous anæsthesia. The shaded area including tragus and anterior wall of meatus remains anæsthetic to tactual (hair æsthesiometer) stimuli. The dotted strip gives the impression of touch or pressure to pain stimuli (needle) with few if any actual pain points.

For making the tests the following appliances have been used: for touch, a horse hair arranged like a v. Frey æsthesiometer, of a length just sufficient, owing to bending on impact, to give tactile instead of a dolorous sensation in case it impinged upon a pain point: for pain, a needle or sharp pin placed obliquely on the end of a light cardboard handle, thus allowing of more delicate stabs of the skin than when held in the fingers; for thermic tests, a camel's hair brush wet with ether for cold, and for heat the warmed head of a pin or else the convenient hot and cold test-tube. Electrical tests have also been used in the majority of the more recent cases. On the skin there is no more satisfactory way of delineating the outline of tactual anæsthesia. A unipolar electrode of fine platinum wire with the faradic current has generally been employed; this gives the electrical sting or "whirr" only on a field of tactual æsthesia. In making the tests the field margins were approached always from a known area of anæsthesia. The patient, so far as possible, was always alone with the observer in quiet surroundings and the observations were invariably deferred when evidence of even a slight degree of fatigue was given by uncertainty or delay in the responses.

Comment will be made:

1. Upon the field of cutaneous anæsthesia.
2. Upon the anæsthesia of the mucous membranes.
3. Upon disturbances of "muscular sense."
4. Upon the distribution to the meninges.
5. Upon the sensory distribution of adjoining fields.
6. Upon the overlap and permanence of anæsthesia.

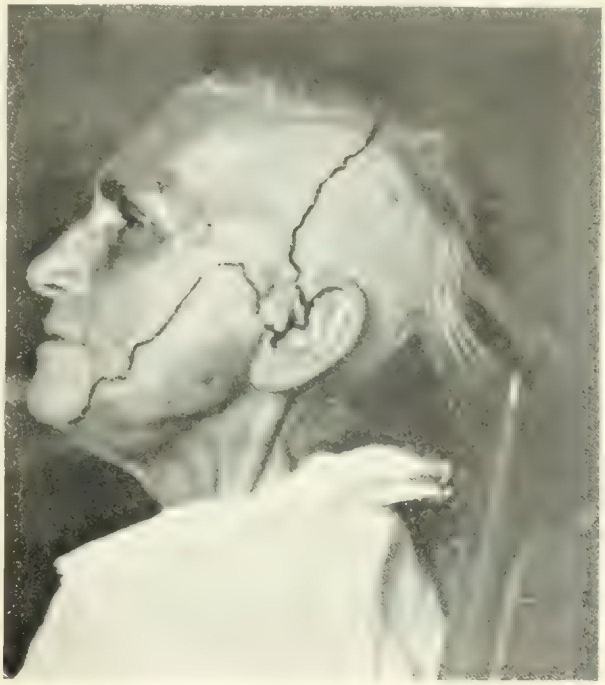

Fig. 2.

1. *Outline of the Cutaneous Field.*—There are two lines which in every case may readily be mapped out as delineating phases of anæsthesia at the *posterior boundary* of the trigeminal skin field (Fig. 1); the more anterior of these lines bounds the area within which anæsthesia is complete to all forms of sensation; the more posterior, outlines the area within which the anæsthesia, though complete to thermic, dolorous and delicate tactual stimuli, nevertheless is not absolute since perception for painful stimuli remains, the impulses being interpreted, however, not as pain but as pressure or contact (common sensation). There exists, therefore, a strip of skin between these two lines from which sensory responses may be elicited, and although, properly speaking, the posterior of the lines encloses the functional area of trigeminal distribution for pain, touch and temperature, the anterior represents the line which would be mapped out by the experi-

mental method on animals as enclosing the field of 'no response' whatever. This will be commented upon later in discussing Sherrington's findings in the monkey.

In the twenty-six cases of trigeminal neurectomy from which these studies have been made the great preponderance of one type, occurring as it does in twenty instances with but little variation from case to case, indicates that this stands as the average normal cutaneous distribution. Instances of this normal type are shown in the accompanying photographs, taken from eight to ten days after the operation, of patients on whom the field had been mapped out (Figs. 2-7). A comparison with the photographs and diagrams of the anæsthesia after cervical nerve lesions (Figs. 14-19) renders it evident at once that the border zones between the cranial (trigeminal) and the adjoining spinal field (second cervical) either offer an exception to the general laws of overlapping which Sherrington has shown to apply to the border areas between neighboring skin-fields of spinal origin, or else through the greater accuracy of the tests which are possible in the human subject, the exact anatomical delineation of a segmental skin-field may be determined, after the section of its dorsal root, regardless of the possible functional overlap with adjoining segments.

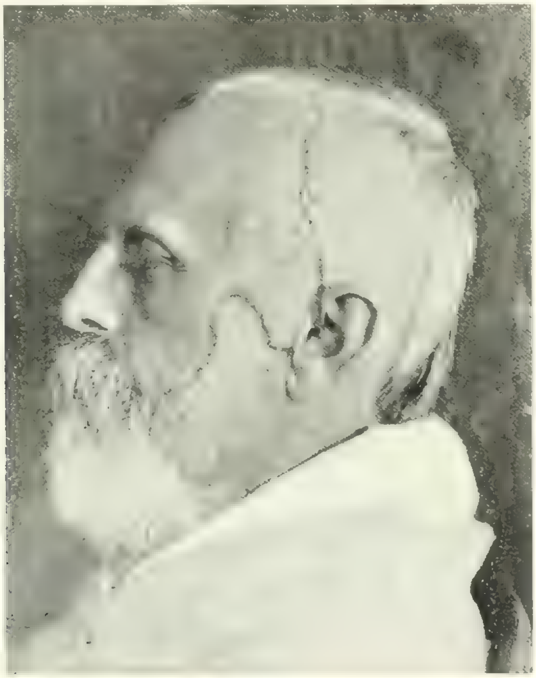

FIG. 3

It has been determined on experimental grounds, as is well known, that the overlap between adjoining segments is sufficient to leave no area with deficient tactual sensativity after the section of a single dorsal root, the tactual overlap in fact being greater than that for pain and temperature, a dorso-ventral strip of at least partial analgesia and thermo-anæsthesia remaining after a single spinal root division.[3]

In the case of the trigeminal field in man, at all events, it seems quite otherwise since the only observable overlap on the trigeminal field, at least of its mandibular portion, after division of the sensory root is for pain alone, although, as already stated, painful impulses from the field of overlap, if it is to be regarded as such, when perceived are not dolorous.[4]

Particular attention has been paid in these cases of trigeminal neurectomy to the delineation of the *field of post-operative tactual anæsthesia* inasmuch as points of chief interest have been obtained therefrom and the outline thus plotted seemingly represents the extent of anatomical distribution of the terminals of the nerve. This boundary line may be traced as follows: Starting from the mid-longitudinal line of the scalp at a point which roughly corresponds with the upper end of the underlying Rolandic fissure, the line crosses the scalp

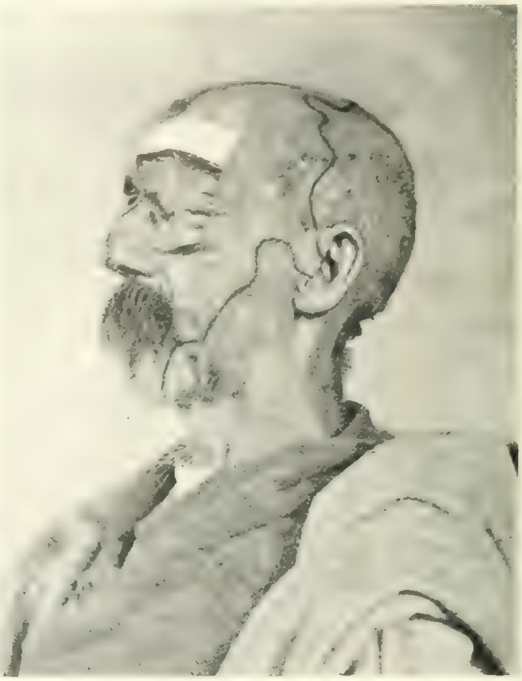

FIG. 4.

FIGS. 2-4.—Photographs of patients 8 to 10 days after the operation showing area of tactual anæsthesia alone.

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[3] Sherrington: The Spinal Roots and Dissociative Anæsthesia in the Monkey. Journal of Physiology, Vol. XXVII.

[4] This statement has been restricted to the field of the N. mandibularis division of the trigeminus since it is possible that the overlap which exists at the vertex between the second cervical field and the ophthalmic division of the trigeminus may be somewhat more marked. This deserves further study. It is not impossible that the first visceral cleft may have furnished a barrier to overlapping ventral to the ear that does not exist in the parts dorsal to it. This may explain the slighter overlap in the ear-cheek-chin portion that exists on the crown. It must be borne in mind, of course, that the Gasserion ganglion represents in all probability a fusion of three separate cranial dorsal root ganglia, the groups of cells corresponding to each division remaining more or less distinct, as the observations, which Dr. Barker and the writer made a few years ago would indicate, the degenerated cells after peripheral evulsion of one or another of the main trunks lying in a definite group and not being scattered throughout the ganglion as might be expected. Sherrington has shown however and clinical observations confirm the fact that the

with some irregularities but generally in a forward and downward direction much as does this underlying cerebral fissure; it then drops to the anterior attachment of the pinna around the edge of which it curves in a backward direction so as to include a small section of the ascending rim of the helix, together with the entire crus of the same; thence it disappears in the external auditory canal at the upper edge of the meatus; from this point the line passes into the canal along its upper wall as far as the tympanic membrane, which is included to a greater or less extent in the anæsthetic area, returns along the lower and anterior wall of the canal to the lower edge of the tragus, where it once more reappears on the exposed cutaneous surface; thence it passes at a greater or less angle in a forward and slightly upward direction across the zygomatic region for a distance of from 3 to 5 cm. before turning and sweeping downward across the cheek, still keeping nearly 5 cm. from the posterior edge of the ascending maxillary ramus (about half-way between the angle of the jaw and corner of the mouth) until it drops under the edge of the horizontal ramus and regains the mid line 1 or 2 cm. below the mental prominence. It is to the auricular portion (Fig. 8) of this "Scheitel-Ohr-Kinnlinie," as it is called by the German anatomists, that the greatest interest attaches, and although through the dissection methods, to which reference will be made later, the trigeminal area has with considerable agreement been made to include a certain portion of the helix together with the tragus, scant mention seems to have been made, even by anatomists, of the extension of the field into the external auditory canal. It is difficult at times to demonstrate the exact outline unless the meatus be large and in some cases it may be necessary to clip away the hair from the tragus before a satisfactory examination can be made. The deeper portion of the canal, together with the drum, is best examined through an aural speculum. As a rule the tactual anæsthesia of its upper and anterior walls may be easily demonstrated. The patient usually will hear the horse hair when it impinges upon the surface, although the unpleasant tickling sensation which follows upon touching the postero-inferior wall of the canal, just as in the normal ear, is not called out. The drum itself, ordinarily exquisitely sensitive, is as a rule anæsthetic to a greater or less extent. In one patient it was found that the tympanum (to all appearances normal) was divided by the handle of the malleus into an anterior and upper anæsthetic portion, touching which with a horse hair gave only a loud rapping noise without tactual impression, and into a posterior acutely æsthetic portion touching which occasioned pain. Dr. Randolph was kind enough to corroborate the results of this finding and was able through his greater skill in intra-aural examinations to accurately map out the boundary line. In other instances I have not succeeded in so clearly demarcating the two fields on the tympanum. It has seemed, in some cases, together with the deeper portion of the posterior wall of the canal to be entirely without tactual sensativity. It may be said, however, that in the great majority of all cases the crus of the helix and the tragus, together with the anterior wall of the auricular canal, represent a point of anchorage, as it were, where the cutaneous lines of tactile anæsthesia are

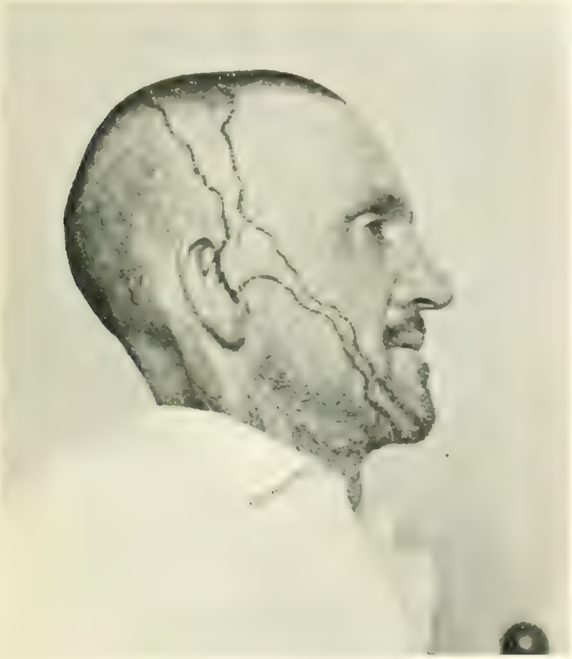

Fig. 5.

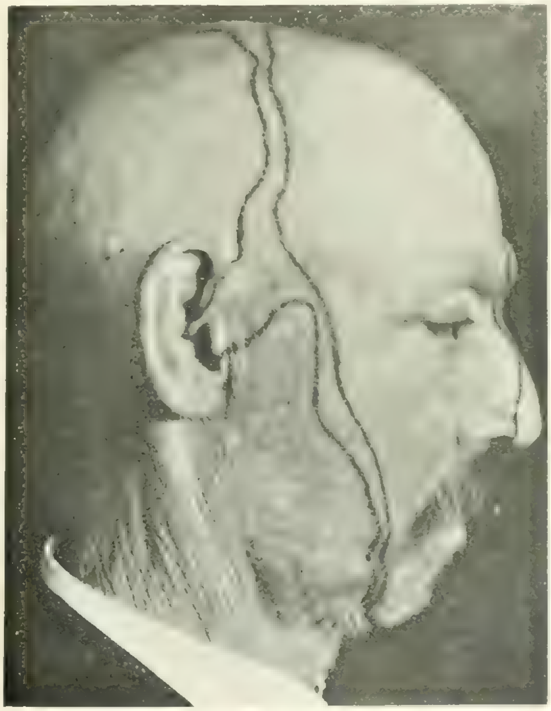

Fig. 6.

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skin-fields of the separate divisions do not run to the mid dorsum. Thus the field of the N. mandibularis does not entirely separate the fields of the 1st and 2d trigeminal divisions from the cervical fields and though its auriculo-temporal branch would suggest an analogue with the posterior division of the spinal nerves, it fails to reach the mid dorsal line.

buoyed, no matter at what angle they may be swept away from this point by the shifting of the skin over the developing mandible and cranium. (Compare the series of diagrams, Figs. 26-30.)

The anterior of the two lines is much more simple in its configuration and needs no description other than that which the diagram (Fig. 1) itself gives. It for the most part lies parallel to the crown-ear-chin line from which it diverges most widely at the crown and ear and approaches most closely at the temporal region, cheek and chin. Occasionally it also bellies out toward the tragus, though it usually bridges across this auricular irregularity in contour of the posterior line with no attempt at parallelism.

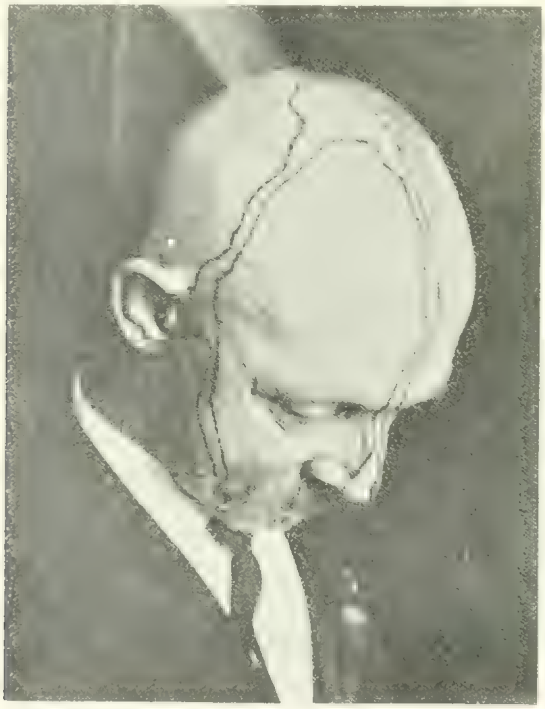

FIG. 7.

FIGS. 5-7.—Photographs showing combined areas of analgesia and tactual anæsthesia ten days after operation.

Variations from the Normal Type.—As has been stated, the above description applies to the posterior cutaneous boundary in the great majority of the cases observed and the variation in outline from case to case is no greater than might be expected from individual differences in the configuration of the underlying skull. In three instances, however, out of the twenty-six there was found an outline possessing somewhat different characteristics, and being alike in all three it may justly be regarded as indicative of a separate type of distribution. In these cases, as in the above, the same double lines were demonstrable. They were, however, set back so that the more anterior corresponded approximately with the more posterior of the normal type, that is, with the line described above in detail, whereas the more posterior of the two included within its boundaries the upper half of the pinna, the antihelix and its crura, a portion of the concha and a considerably greater share of the cheek. This variation is best shown by the photographs of the three cases[5] (Figs. 9-11). I have seen one case also, though only one, in which the outline corresponded with the field which Frohse, through the dissection method, has given as the average type (cf. Fig. 23) and in which the ascending portion of the helix, together with the fossa of the antihelix (fossa triangularis), are included.

The median boundary of the anæsthetic area, determined by tactual stimuli (horse-hair test), corresponded in all cases exactly with the mid-line of the crown, forehead, nose, lips and chin. There is detectable, however, as in the case of the posterior boundary, a very narrow border strip broadening out slightly at the root and tip of the nose, within which painful stimuli are interpreted as touch or pressure; analgesia as such, however, reaches, as does tactile anæsthesia, to the mid line. This is best appreciated by the examination of those cases in which the trigeminal neurectomy has been performed as the first operation, that is, when it has not been preceded by peripheral operations perhaps often repeated. In the latter cases the slight functional overlap, which time has allowed to take place, from across the mid line and from adjoining posterior fields, may accentuate the width and the sentiency of this border zone, though this is not always the case.

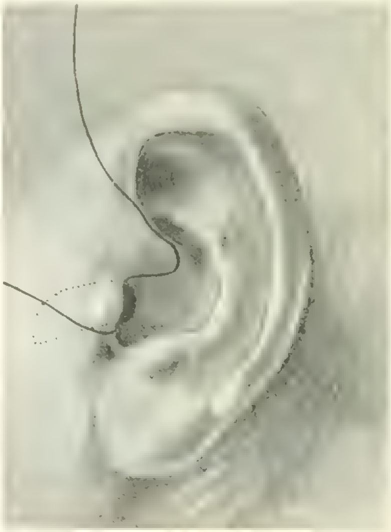

FIG. 8.—Outline of the auricular portion of the trigeminal field determined by the line delimiting tactual anæsthesia.

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[5] There is one peculiarity in regard to the stability of these boundary lines that may be mentioned here since in one of these three cases it was more pronounced than in any of the other patients I have examined, although as a matter of fact it is observable to a greater or less degree in all. This consists in a rhythmic shifting of the lines of anæsthesia. If, for example, the line of tactile anæsthesia over the side of the scalp be rapidly marked out, the patient responding promptly the moment he feels the touch of the hair as it passes on to the area of æsthesia, it may be found after a few moments, should a second examination be made, to corroborate the line, that it has shifted backward perhaps one or two cm. A short time later it may again be found at its original position, and so on. One of the patients,

Before considering the intrabuccal field of anæsthesia it may not be out of place here to compare the above results with the observations made by others, notably by Krause, on this cutaneous field. Relative to six of the cases which form the basis of his earlier (1896) report upon a series of ganglion extirpations, are careful notes in regard to the post-operative anæsthesias. One of his photographs I take the liberty of copying here in outline (Fig. 12), inasmuch as it has found its way into several text-books of anatomy and neurology, having been accepted by the authors as the normal outline of functional anæsthesia after a trigeminal neurectomy. The figure represents the findings of an examination four weeks after the operation. The chart accompanying it shows that all forms of sensation in the areas A and B were at the time of observation abolished (aufgehoben); in C, D and E, greatly reduced (stark herabgesetzt), and and F slightly so (wenig herabgesetzt). Doubtless the partial anæsthesia in the areas of the second and third division in this case have some relation to the many preceding peripheral nerve resections on these branches, the first of which on the inferior maxillary had been performed as much as thirteen years before the ganglion operation. A later observation (2¼ years) on this same patient showed considerable shrinkage, especially in the territory of the first (ophthalmic) division, together with partial return of common sensation in the supraorbital region and a shrinkage of the area away from the median line. In some others of Krause's earlier cases it seems evident from the description that the ganglion cells, particularly of the ophthalmic division, had not been completely removed since sensory perception of the supraorbital territory was relatively so little affected. In two or three of the cases in my series a similar return of more or less complete sensitivity in the ophthalmic division has taken place. These were cases in which from operative difficulties a complete enucleation of the ganglion with evulsion of the sensory root was impossible. In one of them not only was there a partial return for sensations of pain and touch in the area of the ophthalmic division, but also painful stimuli over the cheek gave impulses interpreted as touch or pressure (area of N. infraorbitalis). The lower two-thirds of the ganglion with the intracranial portions of the N. maxillaris and N. mandibularis were certainly removed in this case and the ophthalmic portion sufficiently broken up to render its territory completely anæsthetic for some weeks. It is presumable that in the fragment of the ganglion left at the operation, cells remained which finally re-established connections not only with the traumatized ophthalmic division, but also in part with the severed N. infraorbitalis. Inasmuch as those cases, in which the ganglion with its sensory root has been removed in its entirety, have had no return of sensation other than an insignificant shrinkage of the border areas of the entire field, it seems much more probable that the partial

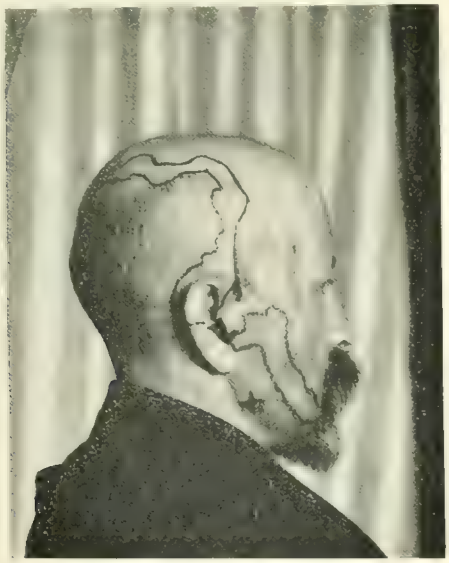
Fig. 9.

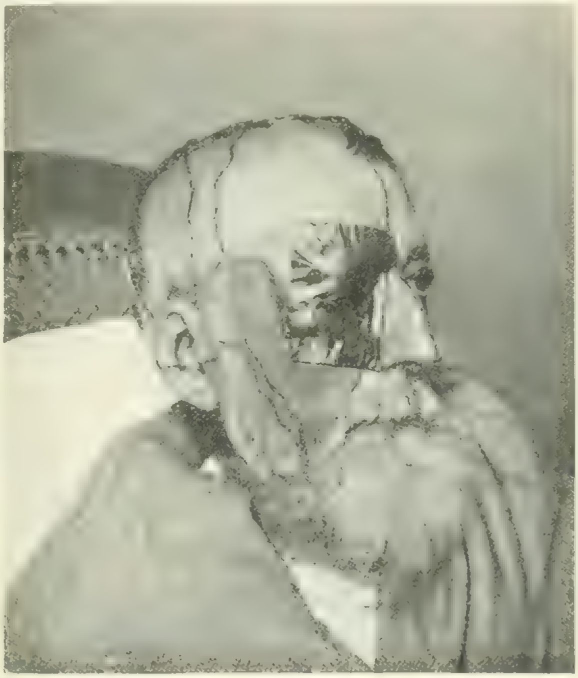
Fig. 10.

an intelligent observer of his own sensations, told me that he was himself aware of this slight contraction and expansion of the field of anæsthesia and that it occurred usually with a definite rhythm. It was noted, furthermore, in this same individual that when a watch was placed at a distance at which its ticking could barely be heard, the sound became plain and then scarcely or not at all audible with the same rhythm as that which affected the change in size of the anæsthetic field. It was then easily demonstrable by attaching to the patient's arm a blood pressure apparatus that a slight rise in systolic pressure of six to eight mm. of Hg. corresponded with the period of more acute hearing as well as with that of shrinkage of the anæsthetic field. When sleepy or fatigued the field of anæsthesia was broadest and evidence of the fluctuation of the boundary was no longer apparent.

Such a shifting is doubtless explicable on physiological grounds and although it occurs but rarely to any great extent, it nevertheless must be borne in mind by those making the tests lest it be the occasion of confusion. In the cases in which the rhythm was definite I have endeavored always to plot the posterior of the lines.

return or persistence of sensation in these cases represents the passage of impulses by way of the partially restored trigeminus rather than by an extensive functional overlap with the cervical fields. Zander has attempted to explain the post-operative sensativity of the ophthalmic field in some of Krause's cases by the supposition that the occipital nerves may at times extend forward as far as the palpebral cleft. From the diagrams of resultant anæsthesia, I would be inclined to put the former interpretation, namely, that of incomplete extirpation, upon one of Friedrich's carefully studied cases.[5a]

It will be noticed in Krause's diagrams that although the margin of anæsthesia approaches the ear, it does not include the tragus and doubtless there was no intent to more than roughly indicate the outlines of the trigeminal divisions. This is the more apparent since he briefly mentions the insensativeness of the anterior wall of the canal in its external portion and comments in the context upon its inclusion in the trigeminal field since two of his patients found in cleaning their ears with "einem kleinen Löffelchen" that they were apt to occasion pain, owing to the insufficient protection of an anæsthetic meatus, by carrying their "Reinigung" too deep, even to the sensative drum. This occurred in one case as late as two and one-third years after the operation.

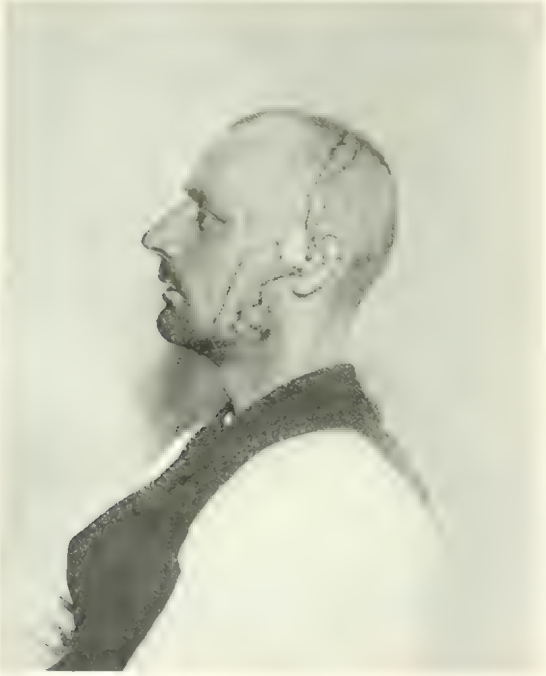

FIG. 11.

FIGS. 9-11.—Photographs of the three instances of variation from the normal distribution. Patients ten days after operation. Anterior line, analgesia; posterior line, tactual anæsthesia.

Krause's observations led him to accept the view of double innervation for otherwise "müsste ja nach Ausrothung des Ganglion Gasseri das gesammte Trigeminusgebiet volkommen anästhetesch sein: unsere Untersuchungen lieferten ober ganz andere Ergebnisse." He explains the variability of his findings on anatomical grounds, a belief to which the investigations of Frohse and Zander seemed to give support.[6] It is much to ge regretted that Krause in his more recent paper has not added to the physiological notes which accompanied this earlier work, since a larger proportion of the later cases have been doubtless more perfect extirpations, and what is more important, have, some of them, been carried out on patients in whom no previous peripheral neurectomies had been performed. It is from such uncomplicated cases especially that the most satisfactory data may be obtained.

2. *Outline of the Mucous-Membrane Field.*—The boundary of the intrabuccal field of anæsthesia may be traced, as has been the skin-field, by beginning at a given point, and for this purpose the muco-cutaneous junction of the lower lip may be conveniently chosen. The line of anæsthesia (Fig. 13) to all forms of sensation corresponds exactly with the mid line of lip, frænum linguæ, tip and dorsum of tongue as far back as a point slightly anterior to the foramen cæcum; thence it passes outward along the row of circumvallate papillæ to the lateral root of the tongue where there is some variation from case to case, though in the majority of instances it passes along the palato-glossal fold, to the upper portion of the anterior pillar of the fauces (Arcus glossopalatinus) which it follows to the uvula. The posterior pillar (Arcus pharyngopalatinus), so far as I have observed, together with the tonsil

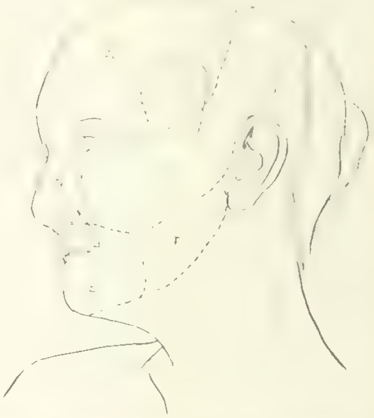

FIG. 12.—Krause's "Beobachtung 3." Showing the results of an examination four weeks after a ganglion extirpation.

[5a] Friedrich. Deutsche Zeitschrift für Chir., 1899, Bd. 52, p. 360.

[6] A case has been reported by Drs. Spiller, Keen and Dercum in which the ganglion was removed, together with an endothelioma of the neighborhood and in which there was only slight consequent hypæsthesia of the face. On physiological grounds it is difficult to conceive of such a condition and that the facial nerve should assume the sensory function of the trigeminus even in an anomalous case seems from a morphological standpoint quite improbable. It is enough to startle the shades of Majendie and Charles Bell into remonstrance. The writer has twice operated on cases of basal tumors involving the Gasserion ganglion (once an "endothelioma" and another time a chondrofibroma) and although the tumor in each instance was entirely extradural and to all appearances occupied the entire Cavum Meckelii, leaving apparently no trace of the second and third rami or of their foramina, only partial anæsthesia resulted from the attempted extirpation of the growth.

and the lower or vertical portion of the anterior pillar, retain their sensation and developed as they are from the parts posterior to the mandibular arch, are supplied, as would be expected, by the glossopharyngeal nerve. Whether the nasal and pharyngeal areas of anæsthesia are cut off from this intraoral field by an æsthetic strip on the roof of the soft palate, from my observations cannot be stated positively, and although there is an overlap here which will be described later, it seems probable that the trigeminal fields of intraoral and nasopharyngeal distribution do so communicate. If this be the case, the line, to continue with its course, curves around the soft palate near its junction with the uvula, gains the roof of the velum across which it passes to the lateral pharyngeal wall; thence upward, dividing in its course the pharyngeal ostium of the Eustachian tube, proceeding thence to the mid line of the vault of the pharynx; from here it pursues again a median path along the internasal septum, keeping in the mid line of soft palate and uvula, both dorsal and ventral surface, hard palate, gums and upper lip to the muco-cutaneous junction again.

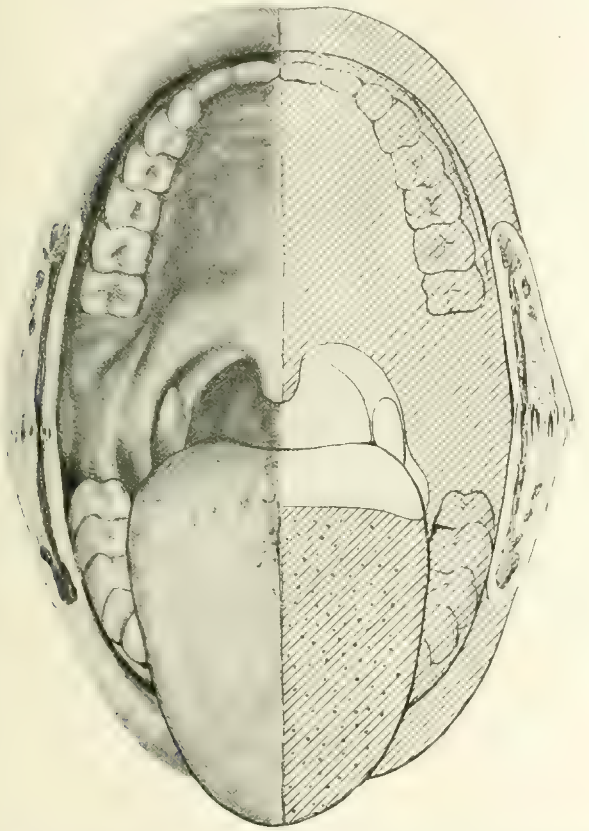

FIG. 13.—Diagram of intrabuccal anæsthesia. Other mucous surfaces, the Schneiderian membrane, dorsum of palate, root of pharynx and half of Eustachian orifice (?) are also without sensitivity.

With the exception of the tongue, as will be described, the entire mucous field within these lines is rendered completely devoid of sensation by the neurectomy: the lips, teeth, gums, anterior two-thirds of the tongue, check, hard and soft palate, uvula, a portion of the pharyngeal vault, together with the entire Schneiderian membrane on one side. Instruments may be introduced into and through the nasal chamber, the patient being unconscious of their presence. The sneezing reflex is abolished, as well as the gagging reflex produced by irritating the soft palate on the side of anæsthesia. The fumes from ammonia, ether and like substances are no longer irritating when inhaled, the irritant quality acting apparently upon the nerves of common sensation alone and not upon these of special sense, for the latter remain unaffected. Some interference with the sense of smell has been described in these cases, but it is probably due to the fact that an abnormal dryness of the mucous membrane persists for some time after the operation and interferes somewhat with the acuity of the sense of smell, for, especially if the membrane be moistened by a saline irrigation, the special sense perception seems equally acute on the two sides.

One portion of this mucous field, owing to its inaccessability, has been less satisfactorily examined than the remainder. This is the field occupying the vault of the pharynx. One observation, however, that has in all cases yielded like results, shows the normal sensitivity of the Eustachian orifice to be much diminished. A Eustachian catheter may be passed through the nares on the anæsthetic side unknown to the patient and be introduced into the ostium of the tube, where it produces very slight if any sensation, provided it is held away from the outer side of the orifice and does not enter the fossa of Rosenmüller.

This observation may be controlled as follows: If the æsthetic mucous membrane of the other nares is cocainized so that the catheter may be similarly introduced without the patient's being aware of its presence, the usual disagreeable sensation is produced the moment the instrument comes in contact with any part of the Eustachian orifice. So far as my observations go, it also seems that the vault of the pharynx above and anterior to the ostium is likewise anæsthetic for tactual stimuli. Examinations of this sort through the nares without direct visual supervision of the points of contact is, of course, open to criticism, and without great success I have attempted to corroborate the findings by tests carried out through the mouth with the aid of a laryngoscopic mirror. Only in exceptional instances has this been possible. The main point, however, which it is desired to emphasize is that the pharyngeal opening of the tube, like the external auditory canal, is probably innervated on its anterior (cephalad) half by the trigeminus and posteriorly by the next adjoining cranial nerve having afferent splanchnic fibers, glosso-pharyngeus or vagus.

After a trigeminal neurectomy that portion of the tongue anterior to the circumvallate papillæ is an exception to the rule of total anæsthesia to all forms of stimuli. Simple tactual impulses produced with a horse hair, as well as those of pain and temperature, are completely interrupted exactly to the mid line. Certain forms of common sensation are, however, preserved. If a cotton swab or a wisp of cloth be moved over the anæsthetic field, its presence is recognized, localized more or less accurately, and its direction of movement appreciated. There are reasons for believing that certain fibers from this area of the tongue not only as the special sense fibers of taste but also of common sensation, pass to the brain by way of the Chorda tympani and the Nervus intermedius (Wrisberg). This question has been entered into more fully in a previous communication[7] concerning the course of the taste fibers. Reasons for believing that the paths for taste fibers were largely, if not entirely, independent of the trigeminus, as well as for believing that some other fibers of common sensation passed together with them from the anterior two-thirds of the tongue were then given. Since writing that paper additional opportunities in seven cases have sufficed to further strengthen the conclusions therein set down. In none of these cases was taste affected in the slightest by the operation; in all of them there was retained over the anæsthetic portion of the tongue this peculiar form of sensitiveness to certain tactual stimuli. An examination, furthermore, of a number of cases of facial palsy, has shown that when the lesion is high enough to interrupt the transmission of gustatory impulses there is an accompanying slight sensory disturbance over the anterior portion of the tongue to these particular forms of stimuli, even though a normal sentiency to touch pain and temperature seems to be present. Thirdly, the good fortune of being enabled to observe a patient in whom both the fifth and seventh nerves were totally paralyzed has shown that no sensation whatever over the anterior part of tongue remained to touch, taste, pain, temperature or to the movement of a swab over the surface. These observations have been sufficient to establish from a clinical basis a personal conviction that there exist afferent fibers of two sorts, common and special sense fibers, which pass from the tongue via the chorda tympani and N. intermedius. It may be seen that morphological studies are in agreement with this.

3. *Disturbances of the So-called "Muscular Sense."*—Comment was made by Charles Bell upon the apparent slight palsy of the muscles supplied by the facial nerve that followed operative or experimental section of the peripheral branches of the trigeminus. Thus, for example, a slight droop of the upper lip with planing out of the naso-labial fold could be observed after section of the infraorbital bundle of the trigeminus. Sequelæ of this sort have since been frequently observed by surgeons after peripheral neurectomies of branches of the fifth nerve and are commonly ascribed to associated injuries of terminal twigs of the facial or to division of fibers of the muscles themselves. Postural deformities of any consequence, such as usually appear in the region of the eyebrow after the customary ganglion incision, are of course due to such an injury of the nerves to the frontalis, corrugator supercilii, and possibly in part to the orbicularis itself. Quite another matter are the phenomena of senso-paralysis which may oftentimes be observed in these patients, though they might not attract the casual glance.

In the period immediately following the neurectomy there may be seen, more marked in some cases than in others, a not inconsiderable hemilateral flaccidity of both upper and lower lips and possibly, as Krause has remarked, a slight flattening of the ala nasæ and lessening in depth of the naso labial fold, a condition somewhat emphasized by the temporary fullness of the tissues due to the vasomotor paralysis. At rest, with the lips closed, the lip margins on the operated side tend in some cases to remain slightly parted; during active movements the asymmetry between the two sides may become somewhat more pronounced, for example, in the effort to whistle when the lips may not be satisfactorily puckered. In one of my cases for a few weeks the postural disturbance was so great as to simulate an actual hemifacial palsy, and only after electrical examination could it be proved otherwise. At a later period the flaccidity is frequently replaced by a corresponding degree of overaction in the expressional musculature, namely, by a slightly drawn position of the corner of the mouth, a deepening of the naso-labial fold, and in old people an accentuation of the wrinkles (crow's foot) radiating from the outer canthus. The principle underlying this phenomenon is of quite a different nature and the overaction is never as marked as in contracture of the muscles during recovery of a true motor palsy. There is not uncommonly seen also a slight "tic" or twitching of the muscles, for instance in those comprising the orbicular or naso-labial group. Of this the patient is unconscious. It must be said that all of these phenomena may be so inconspicuous as to be readily overlooked and in some cases may not be observed at all.

The complete absence of postural sense may, however, be easily demonstrated in another way. It has been noted above that faridization is one of the most satisfactory methods of mapping out the field of anæsthesia, the patient being unaware of the contact of the electrode until it crosses the boundary onto the æsthetic area. If the current be strong enough to elicit contractions in the groups of muscles about the eye, nose or mouth, the movements are not appreciated, provided the patient's eyes be closed so that they cannot be observed, and also provided the twitch be not transmitted to the opposite or æsthetic side of the face. Similarly, passive movements produced in other ways, as by hooking up the ala of the nose or corner of the mouth, are unaccompanied by recognition of the changed position.

The loss of muscle sense may likewise be in a measure responsible for the post-operative postural asymmetry of the tongue and soft palate, though I have been inclined to largely account for the condition in another way. During the operative procedure the motor root of the fifth is almost of necessity sacrificed with resultant unilateral paralysis of the masticatory muscles. Consequent upon the loss of function of the pterygoids, the lower jaw, when the mouth is widely opened, deflects toward the paralyzed side and the protruded tongue remains in the mid line of the deflected jaw, doubtless gaining its sense of position from the posterior attachments to the inferior maxillary bones. The base of the tongue retains, of course, its normal sensitivity and the loss of muscle sense affects the muscle bundles of the anterior portion on one side only. Many patients have some difficulty in placing and especially in retaining the tip of the organ in the mid-line position even of the deflected jaw.

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[7] The Taste Fibers and their Independence of the N. trigeminus. The Johns Hopkins Hospital Bulletin, Vol. 14, 1903, p. 71.

The post-operative asymmetry of the palate, to be discussed more at length elsewhere, may also be attributable in part to disturbances of muscle sense, though I have ascribed it as due chiefly to the paralysis of the tensor palati (M. tensor veli palatini), which has a motor fifth supply. The degree of postural deformity varies greatly in different individuals. The patient in whom of all the cases it was most marked, a preacher, was the only one to appreciate any inconvenience therefrom. When talking rapidly in delivering an address he finds that the palatal sounds are less distinctly enunciated than formerly. In conversational tones this is not apparent.

Other than the transient paralyses of the ocular muscles attributable to a definite cause, namely, to pressure of the instruments against the third, fourth or sixth nerves during the operation, I have never observed any ataxia or postural disturbance of movement in the eyeball consequent upon the neurectomy. It is quite possible that these muscles receive their sensory innervation from another source than the fifth cranial.

4. *The Sensory Supply of the Dura Mater.*—Since the time of Haller's experiments the dura has been recognized as a sensitive membrane. So far as the writer's operative experience goes, it is less acutely so in man than in some of the lower animals; in dogs especially, even when under deep narcosis, a great "pressor" response through the vasomotor center may be reflexly elicited even by slight dural manipulation. The same reaction occurs in man, though seemingly to a less degree. After a trigeminal neurectomy the dura, so far as it is exposed by the cranial opening, is rendered anæsthetic. In a case of basal tumor recently operated upon and in which the ganglion and its trigeminal root were removed along with the larger part of the infiltrating growth, the wound was left open to allow of direct application of the X-rays. The large area of dura of the middle fossa and temporal region thus exposed was found after the operation to be totally without sensitivity.

There is one post-operative symptom, which in a certain proportion of the cases of Gasserion ganglion extirpation has been observed with great regularity. During the later stage of the operation when the superior envelope of the ganglion has been elevated sufficiently well to expose the trigeminal root, an escape of cerebro-spinal fluid almost invariably takes place. In certain cases also, in which there is more than the usual degree of bleeding after extracting the ganglion, it is necessary to insert a drain for two or three days, the cerebrospinal fluid continuing to escape for as many days as the drain remains. This seemingly is the occasion of the dull post-operative headache which chiefly in these drained cases may characterize the first few days of convalescence. The headache, however, in a case of total extirpation is invariably a unilateral one and referred to the sound or unoperated side of the cranium. The same peculiarity remains a feature of the headaches which during subsequent months may be occasioned by one cause or another, such as chance disorders of alimentation. Only on the few occasions in which the extirpation has been incomplete, owing to operative difficulties, and the ophthalmic division with its fragment of the ganglion been left in situ, have these post-operative intracranial discomforts been bilateral. In these cases of partial extirpation, of which there have been two in my series, the sensitivity over the skin-field of the ophthalmic branch has been only affected in part and it is presumable that the filaments to the dura from the same division likewise continue to transmit impulses.

The hemicranial nature of these symptoms in cases of total extirpation points very strongly toward a dural origin for many forms of headache, and offers, furthermore, an interesting suggestion of the relationship between trigeminal neuralgia and its frequent precursor, migraine.

The following quotation from a standard text-book of anatomy will show that in the minds of some there exists some doubt as to the sensory innervation of the dura. "Minute nervous filaments, derived from the fifth, tenth and twelfth cranial nerves, and from the sympathetic, enter the dura mater of the brain to be distributed chiefly to the blood vessels and to the bone, but *partly perhaps to the membrane itself.*" Others, however, consider the nerves to be unquestionably sensory. The more important of them, as described by Arnold and Luschka, are the recurrent nerve (N. tentorii) from the ophthalmic division, the recurrent nerve of the superior maxillary division following the meningeal artery and its branches, and two recurrent nerves from the mandibular division, one to the middle fossa and a small branch to the occipital dura, entering the condyloid fossa with the hypoglossal. Charpy, in an excellent chapter on the "Coverings of the Central Nervous System,"[8] sums up the matter as follows: "Comme on le voit, si on excepte le rameau du pneumogastrique et quelques filets émanés des plexus sympathiques périvasculaires, c'est le trijumeau qui fournit la tolalité des nerfs propres de la dure-mère."

5. *Sensory Outline of Adjoining Skin-fields.*—Extensive operations on the neck, in which the ventral cutaneous branches of the second and third, or even of the second, third and fourth cervical segments are sacrificed, serve to isolate the trigeminal skin-field within an enclosing area of cutaneous anæsthesia. An opportunity is thus given, by comparing the anterior outlines of the anæsthetic field so produced with the posterior outlines of the anæsthetic field resultant to a trigeminal neurectomy, of determining the extent and character of functional overlap between these adjoining areas.

The cases which have for the most part best served this purpose have been those of complete extirpation of the cervical glands (Figs. 14-15), though operations of other sorts necessitating peripheral nerve divisions have also furnished material for study. The anæsthesia occasioned by these lesions is a much less permanent one than that in the trigeminal area after division of the root of the fifth nerve, and consequently it is advisable to determine the outlines as early as possible after the operation. Most of the areas have been plotted from the seventh to the tenth day, that is, as soon as the surgical dressings would allow of an exposure of the parts.

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[8] Poirier et A. Charpy: Traite d'Anatomie Humaine, 1901, Tome III, Systeme Nerveux, p. 96.

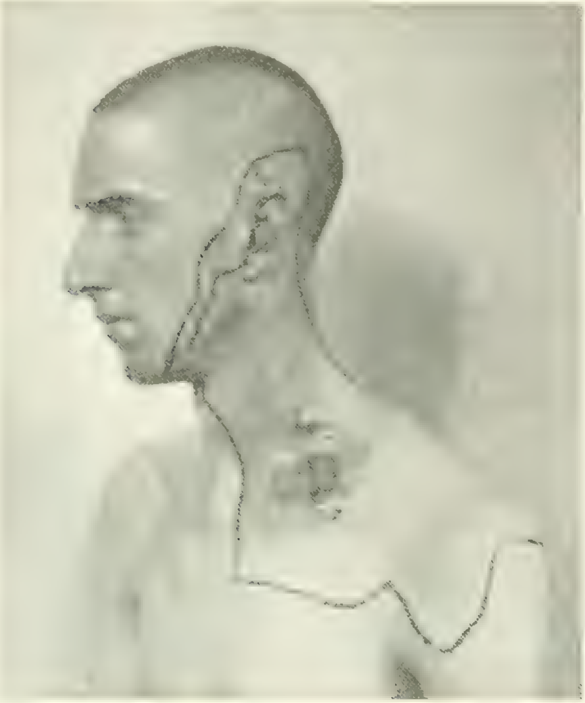

Fig. 14.

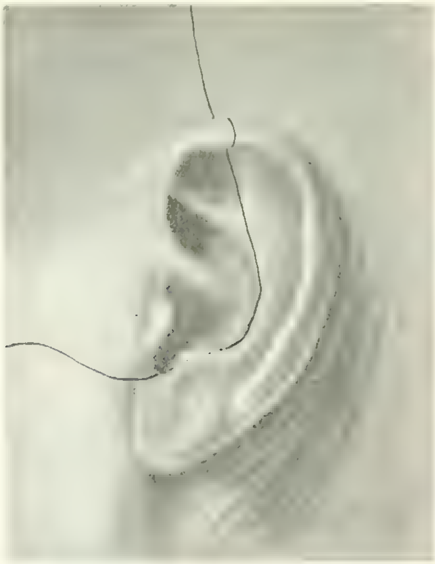

Fig. 16.—Average outline of the auricular portion of the cervical field delimiting the area of tactual anaesthesia.

As in the study of the trigeminal field, so here chief stress will be laid upon the outlines related to the ear. The line delimiting tactual anaesthesia (horse-hair test) (Fig. 16) in the large majority of cases studied lies on the temporal region somewhat farther back than the tactual line of the trigeminal field, strikes the pinna at about its upper mid portion, ascends over the edge of the helix to the outer face of the ear, which it crosses behind the fossa triangularis to the antihelix; the ridge of this latter structure it follows, passing around the posterior margin of the concha to the incisura intertragica, the line usually dipping in somewhat on the inner face of the antitragus; from the incisura intertragica, 5 mm. or more below the point of emergence of the trigeminal line for touch, it passes out onto the cheek usually

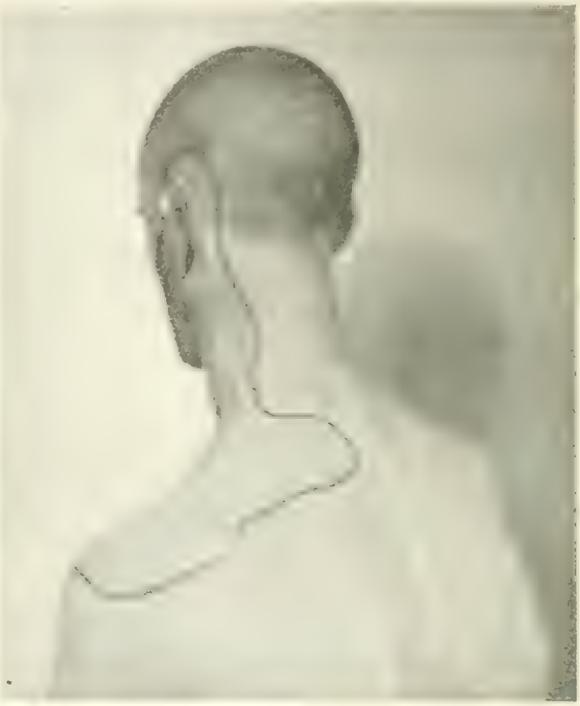

Fig. 15.

Figs. 14 and 15.—Area of transitory anaesthesia after extensive 'glands of the neck' operation with sacrifice of ventral branches (CII, III and IV) of the cervical plexus.

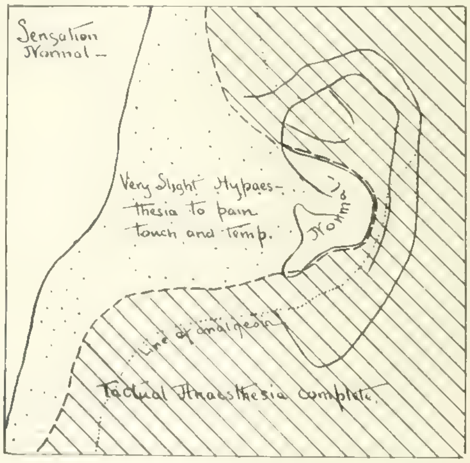
Sensation Normal –
Very Slight Hypaesthesia to pain touch and temp.
Normal
Line of analgesia
Tactual Anaesthesia complete.

Fig. 17.—Charted 8 days after 'glands of neck' operation. Boy of 12. Showing medium (average) vagus area.

in a forward and downward direction instead of forward and upward as does the trigeminal line.

The line of analgesia and thermo-anæsthesia lies from a few mm. to about one cm. posterior to this tactile outline.

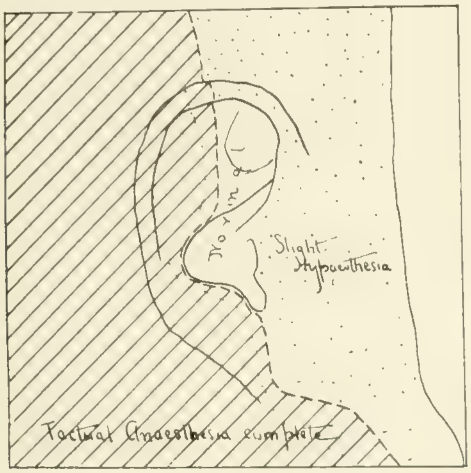

FIG. 18.—Eleven days after "glands-of-neck" operation. Girl of 20. Large vagus area.

There can be detected, also, in almost all cases, a clear-cut boundary on the cheek which corresponds with the anterior of the lines described with the trigeminal field and within which there is an appreciable though exceedingly slight hypæsthesia to all forms of sensation, to pain, touch and temperature.

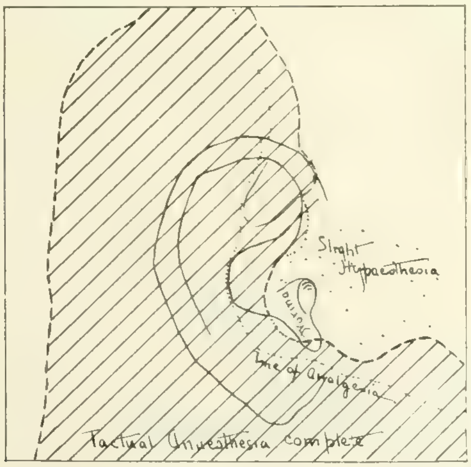

FIG. 19.—Eight days after "glands-of-neck" operation. Small vagus area.

FIGS. 17-19.—Show areas of "remaining æsthesia" in fields of trigeminus and vagus after section of cervical nerves (N. auricularis magnus and N. occipitalis minor).

Shaded area, within broken line = field of tactual anæsthesia.

Dotted area, within solid line (Figs. 17 and 18) = field of slight hypæsthesia to pain touch and temperature.

Dotted line delimits anterior margin of analgesia.

These several outlines may be better appreciated by the three drawings (Figs, 17, 18 and 19), which give at the same time some of the variations seen in this area.

It will be seen, in Fig. 17, that the outline of tactile anæsthesia of the cervical field, with the exception of the con- presents almost an exact negative of the corresponding line of the trigeminal field. This has been observed in several cases. A photograph of the outline of one of them is here given (Fig. 20), a case in which the posterior root ganglia of the second and third segments on the left side were removed from the intervertebral notches for intractable neuralgia of this region.

The concha itself, wholly or in large part, as will be seen, retains its normal sensitivity, and together with the posterior wall of the external auditory canal it represents a field of distribution interposed between the trigeminal and cervical areas. It has been generally conceded by anatomists that this area is supplied by the peculiar aberrant cutaneous branch from the vagus, the R. auricularis nervi vagi of Arnold.

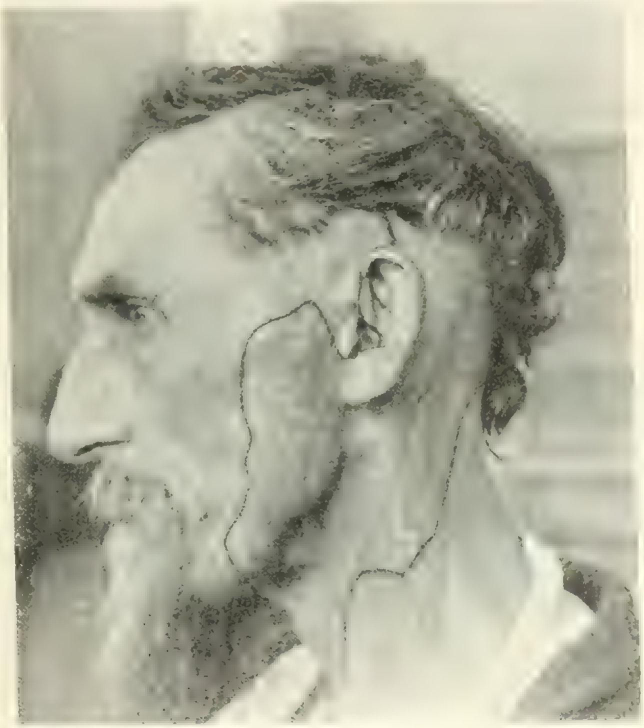

FIG. 20.—Segmental area of tactual anæsthesia after removal of 2nd and 3rd posterior root ganglia.

6. *Overlapping and Permanence of Anæsthesia.*—What has been said in the preceding section will have shown that the overlap between the skin fields of the trigeminal and cervical areas is less extensive and functionally less perfect than anatomical and experimental evidence would have led one to expect. If, as seems probable, the strip of hypalgesia (Fig. 1) is to be taken as representing the overlap on to the trigeminal field from the area of C II, it not only is possessed of very slight sensativity in the early post-operative period but also, so far as I have been able to learn from the examination of late cases, never returns to anything like its normal condition of æsthesia. In only seven cases of the ganglion series has it been possible to make comparative examination after long periods of time: one of them a year, two eighteen months, three two years and one four years after the operation. In all of these cases, with two exceptions, the old outlines

have still been clearly demonstrable, the only change being that of slightly increased sensativity in the strip of overlap, though it remains considerably below a normal condition of æsthesia. The two exceptions were as follows: one, an incomplete extirpation in which sensation with some hyperalgesia had largely returned in the territory of the ophthalmic division, the other, one of the group constituting the trigeminal subvariety (Fig. 9) and, though a complete extirpation, there had been after two years a shrinkage of the field to the normal or average configuration (Fig. 21) a finding which would have served to make one somewhat skeptical of the accuracy of the original outlines had they not been carefully and repeatedly plotted. This, too, was one of the cases in which the rhythmic shifting of outline mentioned above had been especially evident, the most postaxial position of the line having been photographed in the original. In many of these late examinations on account of the growth of hair I have felt less certain of the persistence of the original lines on the scalp though in this case (Fig. 9 and 21) and in one other, owing to baldness, it was possible to trace them to the longitudinal line of the crown.

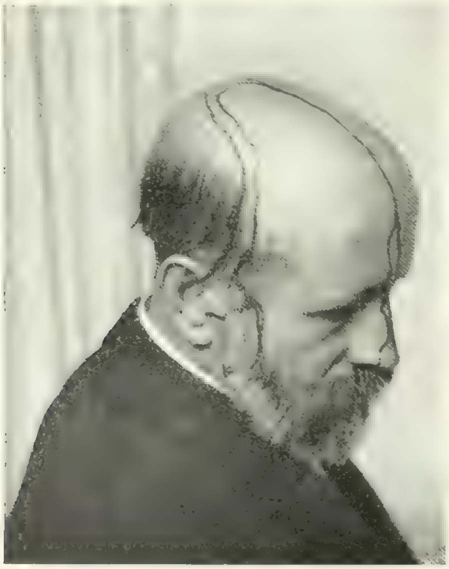

FIG. 21.—For comparison with Fig. 9. Areas of anæsthesia to pain and touch two years after the neurectomy.

The median line or crossed overlap, from the opposite side, after the lapse of time remains likewise insignificant and physiologically incomplete, it being possible to demonstrate tactual hypæthesia to the mid-line after years, in spite of the slight increase of sensativity which appears especially in the nasal portion of the mesial strip.

The same is true for the mid-line of the mucous membrane field where the functional crossing is trifling. One portion of the intraoral field, however, in several cases seems to have largely regained its sentiency, namely, the anterior pillar of the fauces, the uvula and the margin of the soft palate. It is this return of sense perception along the velum that has [illegible] [illegible] [illegible] upon the [illegible], [illegible] above, as a probable one between the pharyngeal and oral portions of the trigeminal territory.

What has been said applies only to the overlap from the adjoining areas on to the trigeminal field in conditions of trigeminal neurectomy. In the cases of cervical nerve lesion the almost complete restoration of normal anæsthesia has probably been due to the fact that the peripheral nerves alone have been sacrificed and nerve reunion rather than trigeminal overlap has been responsible for the return of sensation. In one only of the cervical cases was the anæsthesia due to a root division (Fig. 20) and there has been no opportunity of examining this patient since his discharge from the hospital. I am inclined to the opinion, however, that overlap from the trigeminal onto the cervical fields is functionally less than from the cervical onto the trigeminal, for the slight though appreciable dulling of sensation along the posterior edge of the trigeminal area immediately after the cervical lesions (Fig. 17-19) shows the anterior limit of cervical distribution, surprising though it may be that one is able to demonstrate overlap in this way. It is not impossible, however, that what I have considered as a subvariety of the trigeminal area (Figs. 9-11) may be nothing more than the corresponding overlap onto the cervical field, demonstrable immediately after the trigeminal lesion and sufficiently noticeable in three cases only though possibly present in inappreciable degrees in all.

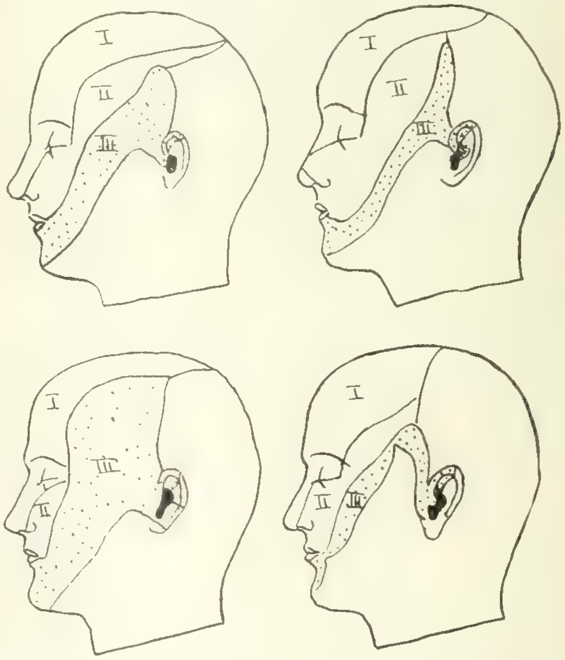

FIG. 22.—Frohse's four types of trigeminal distribution. Field of mandibular division is dotted. Vagus field solid black.

The anterior or posterior overlap from the auricular skin-field innervated by the vagus, if present at all, seems to be inconsiderable.

II. ANATOMICAL RESULTS GIVEN BY THE DISSECTION METHOD.

We may now for purposes of comparison turn briefly to the consideration of the results obtained by other methods than the clinical one. Those anatomists who have made this area the object of particular study, notably Frohse and Zanger, have devoted their attention largely to the cutaneous distribution. Their painstaking labors seem to have indicated that the variation in outline of the main field, from case to case, is considerable and particularly that the extent of the fields for the three trigeminal subdivisions shows great individual differences; that even in the same individual the distribution on the two sides of the face may be very different; that there is a wide anatomical overlap, "Verbreitungsgebiet," between the adjoining fields; and, Zanger, especially, that it is possible by careful dissection to demonstrate fibers crossing the mid-line, more noticeably at the nose and lips. They have both emphasized the absence of trigeminal fibers to the skin covering the parotid and masseteric areas, a condition which had escaped the notice of their predecessors, and, may I add, of many of their followers. Frohse in his elaborate monograph[9] gives not only the variations which he has found, but compares them with the fields delineated in the familiar diagrams of Strümpell, Merkel, Landois and others. In Fig. 22 are given four types of skin-fields as his personal dissections have led him to picture them,[10] the first of which, inasmuch as it corresponds with the diagram which he had furnished for Krause's (1896) monograph (cf. also Frohse's outline in Fig. 23), I take to represent the average type as he has found it. His four figures all illustrate well the "anchorage" of the field at the external auditory meatus. Excepting the inclusion of the helix about to its mid summit, as well as the fossa of the antihelix, a distribution which I have found to be functionally demonstrable in one case only, the outline in this first figure is practically the counterpart of the skin field demarcated in the great majority of my cases. Frohse also emphasizes the presence of the vagus field its area being somewhat variable in extent though largely confined to the concha.

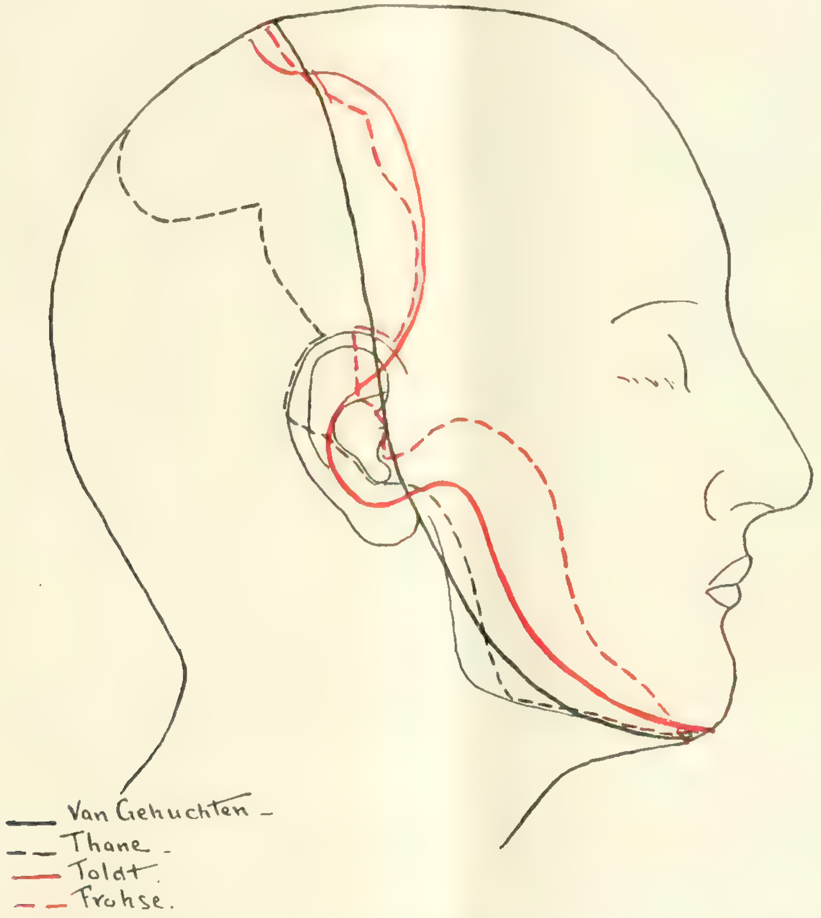

Fig. 23.—Posterior boundary of the trigeminal skin-field as given by various anatomists.

In Fig. 23 a composite has been made of the trigeminal outlines given in some of the standard anatomical works. Many more types might have been added for there are a great number of them, but these will suffice. Van Gehuchten,[11] it will be seen, gives merely a schematic outline within which the skin covering the parotid and masseter regions is included. Toldt,[12] incloses the vagus field together with the antitragus within the trigeminal area. Thane[13] gives a still more posteriorly placed auricular line which, like Toldt's, includes the vagus field and also most of the helix and antihelix, the outline corresponding closely with the field of the subvariety which has been mentioned as occurring in a small percentage of my cases. Other authors as Spalteholtz, following Zander,[14] have given a somewhat confused figure with indefinite outline, in their desire to represent the anatomical variations and overlap. Zander's diagram otherwise is for the most part in accord with Frohse's and his excellent article is given up largely to the consideration of anatomically demonstrable overlap.

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[9] Fritz Frohse: Die oberflächlichen Nerven des Kopfes. Berlin-Prag, 1895.

[10] Bardeleben, Haeckel und Frohse: Atlas der topographischen Anatomie des Menschen. Dritte auflage, Jena, 1904.

[11] Anatomie du Système Nerveux. Troisième Edition. Louvain, 1900, Vol. 2, p. 150.

In many of the newer anatomies, in spite of the omissions of detail in describing skin-fields, there will be found in the context mention of the finer distribution; as that of Arnold's nerve, of the branch from the auriculo-temporal to the external auditory meatus; of the filament to the tympanic membrane, etc. In Schwalbe and Siebenmann's monographs on the Ear[15] will be found gathered most of the available information in regard to the distribution about the external and internal ear, though I have not found even there comment on the supply to the Eustachian tube. According to Henle, however, certain branches of the superior nasal group from the spheno-palatine ganglion terminate in the neighborhood of the Eustachian orifice. The distribution of Arnold's auricular branch from the vagus has been traced with particular care by Frohse and interposed as it is between the auricular branches of the fifth cranial and those of the second cervical fields the possibilities of complex innervation of the external ear are great. As stated by Soulié[16] "c'est le pavillion de l'oreille qui, en raison des sources multiples de son innervation, présente les anomalies les plus fréquentes; c'est d'ailleurs à cette innervation complexe qu'il doit de conserver sa sensabilité presque indemne lorsqu'une de ses sources d'innervation vient à etre supprimée."

In consideration, therefore, of this multiple innervation, particularly of the auricle, and of the variability of field configuration shown by Frohse and the demonstrable overlap between the fields according to Zander, it is surprising how much conformity there seems to be in the clinical outlines in a comparatively large group of cases and how closely the tactual-line delineation of these cases corresponds with the average field determined by Frohse's dissections.

3. The Results of Animal Experimentation.

From the standpoint of physiological experimentation the investigations made by Sherrington[17] to determine the segmental skin-fields on the macaque are so far superior in extent and in accuracy of detail to any similar observations which have ever been made that for purposes of comparison with our clinical findings they alone need be referred to here. The method chiefly used was that designated by Head as the "method of remaining æsthesia" in which the extent of a given skin-field is determined, after the intradural section of two or three dorsal nerve roots adjoining, both on the cranial as well as caudal side, the particular root whose distribution was the object of study. In this way an æsthetic dorso-ventral strip of skin would be left in the midst of an anæsthetic field. It need hardly be repeated here that the experimental section of a single dorsal root, at least of the spinal segments, leaves no area from which tactual responses may not be elicited even though there may result only partial loss of sensitivity to some other forms of stimuli. This is due to the almost complete tactual overlap of a single dermatome by the nerve terminals from adjoining root fields, the condition for each unit being that of almost complete double innervation. I have had an opportunity of corroborating in man the accuracy of these laboratory findings in so far as they apply to one of the spinal segments, by the study of a patient in whom a dorsal root in the cervical region had been divided during the enucleation of a tumor of the meninges. This well recognized law of overlap seemingly does not apply in its full force to the cervico-trigeminal boundaries, nor to the field margins of the three trigeminal divisions. If we are to consider the N. trigeminus and its ganglion as representing a fusion of three sensory cranial units, the severence of peripheral connections with one of its divisions should not leave a tactually anæsthetic field. This is, however, not the case for section in man of the N. mandibularis alone for example, leaves an anæsthetic skin-field whose boundaries in the early post-operative period correspond with the anatomical distribution and with the physiological field which would be determined by the "method of remaining æsthesia." If the laws of functional overlap were here applicable the other divisions of the fifth and the second cervical fields would so encroach on this area as to mask its tactual outlines.

On section of the trigeminal root, it being the most anterior of the sensory nerves of the body, and overlap across the mid line being so slight, there naturally results a large area of anæsthesia, the field of double innervation only being possible at its posterior border. Sherrington found that such a trigeminal section in the monkey left a field of complete insensitivity within the anterior line shown in Fig. 21 c., which at the same time supposedly represents the anterior limit of functional distribution of the cervical segments. This line doubtless corresponds for the macaque with the anterior of the lines determined in man (Fig. 1), and herein lies the chief difference between the experimental and clinical findings. It is almost impossible in dealing with animals to differentiate between the character of responses to the various forms of stimuli and all must be set down alike. Hence the entire extent of the trigeminal skin-field, after posterior root division, cannot be mapped out as it can in man by the employment of delicate tactual stimuli. Were communication impossible between the observer and the patient, as is the case in the laboratory experiment, the functional incompleteness of the overlap in man also would pass unobserved, since responses to pain (though not dolorous as stated above) may be elicited from the trigeminal posterior-border-strip. (Fig. 1).

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[12] Anatomisches Atlas, 1903.

[13] Quain's Anatomy, 10th Edition, 1895, Vol. III, Pt. II, "The Nerves."

[14] R. Zander: Beitrage zur Kenntniss der Hautnerven des Kopfes. Anatomische Hefte, 1897, Bd. IX, p. 1, Merkel's Festschrift Volume.

[15] Bardeleben's Handbuch der Anatomie des Menschen. Jena, 1897, Bd. V, Lieferung 6.

[16] Poirier et Charpy's Traite d'Anatomie Humaine. Paris, 1901, Tome 3, p. 834.

[17] C. S Sherrington: Experiments in Examination of the Peripheral Distribution of the Fibers of the Posterior Roots of some Spinal Nerves. Part II. Philosophical Transactions of the Royal Soc., London. Series B, Vol. 190 (1898), p. 45-186.

After experimental division of the cervical nerve roots, Sherrington also determined a line representing the posterior border of functional distribution of the trigeminus which, although it includes in the diagram (Fig. 24b) the entire ear and is somewhat more posteriorly placed than in our clinical cases, nevertheless the posterior edge of the upper field of response as given in his paper (Philosoph. Transac., 1898, Vol. 190, p. 54), is almost in exact accord with that determined in our cases of cervical nerve lesion. Here again the anterior boundaries of hypæsthesia found to exist in man would be indeterminable in the animal. In Fig. 24abc, furnished for one of Head's papers, Sherrington has so incorporated his findings as to demonstrate the extent of overlap. It will be seen that the second cervical field practically in its entire extent is doubly innervated. Although our clinical observations cover merely the anterior half of this field they are in accord with the experimental work, however, only in so far as the latter concerns the field of *no response* to any form of stimuli, for the overlap itself is of a different nature and is functionally possessed of a much lower plane of sensativity than had been pre-supposed.

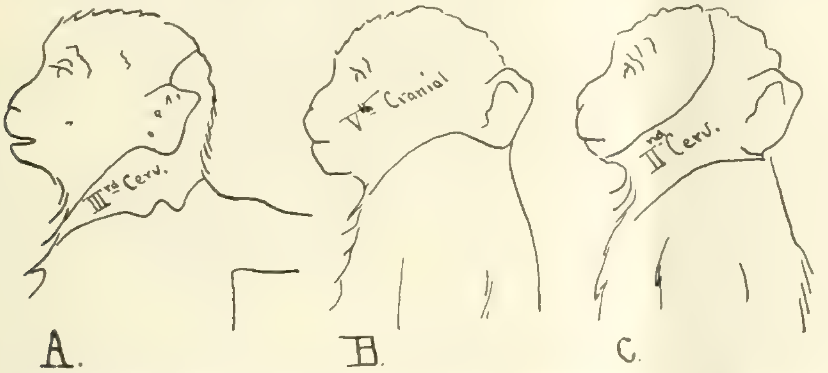

FIG. 24.—Skin-fields of 2nd and 3rd cervical segments and of 5th cranial determined in the macaque according to the method of "remaining æsthesia." Note that overlap between 5th cranial and 3rd cervical is sufficient to completely cover the 2nd cervical. (Sherrington.)

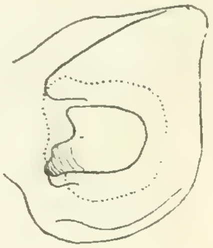

FIG. 25.—Within dotted lines lies the "completely delimited area of auricular of vagus" determined experimentally for the macaque. (Sherrington.)

By the "method of remaining æsthesia" Sherrington succeeded also, for the macaque, in demonstrating the presence of the vagus skin-field although for this purpose a very difficult and severe operation was necessitated, namely an intracranial section of the trigeminal root and at the same sitting an intraspinal division of the upper cervical roots on the corresponding side. This was accomplished in two instances, an æsthetic field remaining (Fig. 25) which was considered to represent the vagus (?) distribution to the skin. A similar field, as has been seen, may be determined in man after trigeminal and cervical root division, owing to the functional incompleteness of overlap. The area in the monkey, according to Sherrington, "includes and immediately surrounds the external auditory meatus. It takes in practically the whole of the concha, the antitragus, part of the tragus and part of the antihelix; also part of the fossa of the antihelix." He considers that this field receives in part a quadruple innervation being overlapped not only by the trigeminus but by the second and third cervical segments.

So far as it has been possible to carry out the tests, the observation on the field of anæsthesia over the mucous membranes, after trigeminal neurectomy in the monkey, are in close agreement with the clinical determinations given above. Sherrington notes that the anæsthesia extends fully up to the median line across which an overlap from the opposite side "is very slight or non-existent."

To summarize the question of overlap between the trigeminal and cervical areas, it may be said: That trigeminal root division in man gives a field of total insensitivity which corresponds with that determinable in the monkey, the complete extent of the skin-field, however, remaining demonstrable, owing to the functional insufficiency of the overlap, delicate tactual anæsthesia persisting over the entire field.

Furthermore, that after division of the cervical branches (roots in one case) the anterior boundary of total insensitivity corresponds approximately with the experimental findings, tactual anæsthesia to delicate stimuli, however, remaining complete (exclusive of the vagus field) almost as far forward as the posterior line delimited in the same way for the trigeminal field. Thus in clinical cases the "method of resulting anæsthesia" serves as well for the establishment of the outline as that of "remaining æsthesia."

4. Embryological Basis for Sensory Distribution.

Without entering into a discussion of the homologies between the cranial and spinal nerves, a subject which has inspired much of the recent work on the development of the lower vertebrates and one which still remains in a somewhat discordant state, the generalization is sufficient for our purposes that the N. trigeminus bears in its structure and in its peripheral and central connections a close parallelism with the double system of ventral and dorsal roots of the spinal segments and it is possible to establish for this nerve and for those cranial ones which follow a certain metameric disposition similar to that characterizing the spinal nerves.

So long as it represents the only pathway for all the splanchnic and somatic afferent fibers from that portion of the head which has developed anterior to the first visceral cleft, it is immaterial for our purposes whether or not the Gasserion ganglion represents the fusion of one or more cranial dorsal root ganglia.

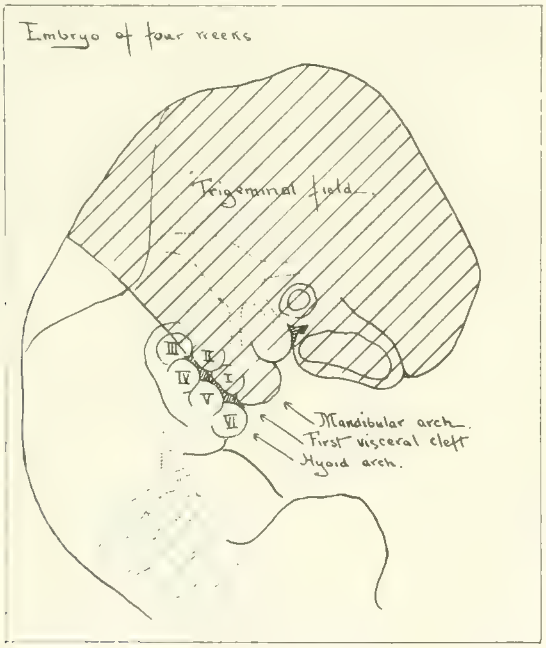

Fig. 26.

In the early embryo (Fig. 26) this deep cleft serves to divide the mandibular bar, which is innervated by the N. mandibularis division of the trigeminus, from the posteriorly placed hyoid arch whose main nerve is the N. facialis. Around the dorsal end of the cleft lie grouped the six cartilaginous tubercles (Fig. 26) which according to the investigation of Wm. His, Jr., represent the rudiments of the external ear. Two of them according to his description lie on the mandibular side of the cleft and develop, one, into the tragus, the other into a portion of the helix (its crus according to Schwalbe). The third protuberance (tuberculum intermedium) His places at the upper end of the cleft possibly developing from its mandibular, possibly from its hyoidal side; it is destined to form the anterior ascending portion of the helix. The fourth, fifth and sixth tubercles develop from the hyoidal arch and are the rudiments respectively of the antihelix, the antitragus and the lobe of the ear. Schwalbe[18] and Gradenigo have a somewhat different adult destination for these hyoid tubercles, though the general plan is much like that of His. Of the helix itself only a portion of its ascending limb arises from the mandibular arch whereas the major part is hyoidal in origin. Had the writer been sufficiently familiar with the plan of development of the ear before the clinical observations were made, the configuration of the auricular portion of the field might have been anticipated; the sensory nerves reach the skin field before the disappearance of the cleft and naturally enough the tragus, the crus of the helix, and at times a part of its ascending portion, together with the anterior wall of the external auditory canal, retain a trigeminal innervation. In the accompanying series of figures (Figs. 26-30) an effort had been made to schematize the development of this fifth cranial skin-field and to show the effect upon its configuration of the auditory point of anchorage, for here it remains fixed while the growth of the lower jaw and occiput crowd, as it were, the underlying structures out from under their original cranial trigeminal skin covering. It is quite possible that the third or even the fourth auricular tubercle may in certain cases have originally been of mandibular origin thus a portion of the antihelix, together with its fossa would naturally be innervated in the adult by the trigeminus. The subvarieties of auricular distribution which have been described might thus be accounted for.

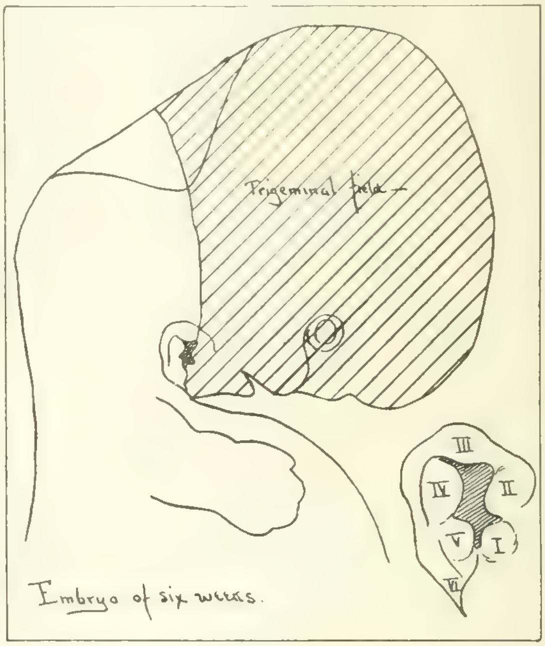

Fig. 27.

In similar wise may we account on morphological grounds for the distribution to the mucous-membrane field of the adult. The tongue develops from a tubercule (the tuberculum impar of His) arising from the mid-line of the floor of the pharyngeal wall at the junction of the lateral mandibular bars or between these and the hyoid arches and so receive chiefly a fifth cranial nerve supply. Its posterior portion however arises from a fusion of the bases of the second and third arches and for some time these anterior and posterior sections of the tongue are separated by a deep V-shaped cleft which runs closely parallel with the line of circumvallate papillae; these papillæ, however, develop from the anterior or mandibular portion, lie a few mm. in front of the line of division and should remain innervated by the trigeminus. This I have not succeeded in demonstrating, for the area is difficult of access.

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[18] "Das äussere Ohr." Bardeleben's Handbuch der Anatomie des Menschen, 1897, Bd. 5, Zweite Abteilung, p. 129.

The palate possesses another border area, the configuration of which is explicable by developmental conditions. Arising from the maxillary process by two shelf-like growths which meet and unite in the mid line, thus closing off the nasal from the oral cavities, the palate in large part naturally has a fifth nerve supply. The shelves, however, according to Minot, extend back across the second and third branchial arches and thus the palatal attachments in their lower and posterior position receive, as would be expected, a nerve supply other than from the fifth cranial. The tonsil also which has developed from an anlage in the second visceral cleft, receives a glosso-pharyngeous supply.

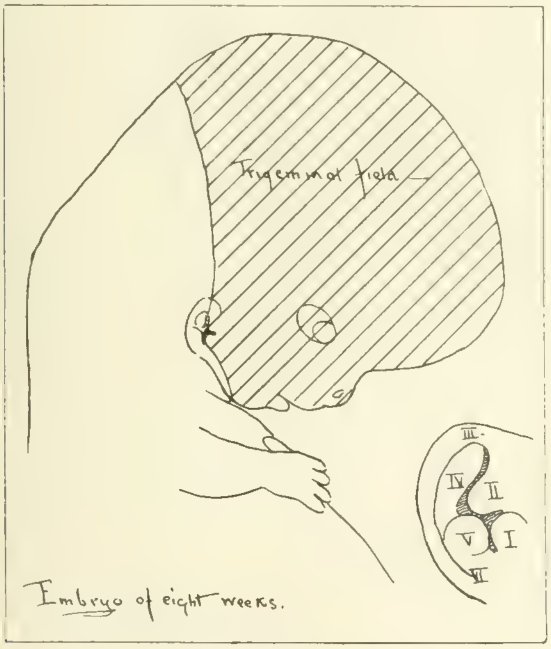

FIG. 28.

Although the matter has not been completely worked out, it may be said in general that there is a particular cranial nerve originally destined in large part for each of the branchial arches, and that, as each of these nerves approaches the dorsal end of the cleft, it divides sending its main branch to the arch of destination and a smaller anterior (præ-trematic) branch to the arch lying anterior to it. Thus, the N. facialis, the particular nerve for the second or hyoid arch, sends forward a branch into the mandibular arch; the N. glossopharyngeus, the nerve of the third arch, sends forward a branch into the second and so on. The facial nerve, however, although generally accredited by morphologists as having the characteristics of a mixed nerve, is not commonly believed to possess a sensory function. It is quite likely, however, that splanchnic afferent fibers pass to the facial by way of the large superficial petrosal and I have been inclined, also, from the clinical evidence cited above, to ascribe to this nerve not only the taste fibers, but also fibers conveying the peculiar form of sentiency which remains in the tongue (its tuberculum impar portion) after a trigeminal neurectomy. One would expect also, did the facial in man have afferent fibers, that the cutaneous field of the adult which has originated from the covering of the hyoid arch would be likewise innervated by this nerve so that the portion of the ear developing from the hyoid tubercles would have a facial supply. It is perhaps worthy of note in this connection that Arnold's nerve from the vagus supposedly destined for the auricular skin-field, commented upon above, has invariably a large anastomosis with the facial as it crosses the lower end of the Fallopian canal. Whether there may not be some afferent fibers consequently from the seventh in this peculiar aberrant nerve is worthy of investigation. It occasionally passes entirely into the facial trunk.

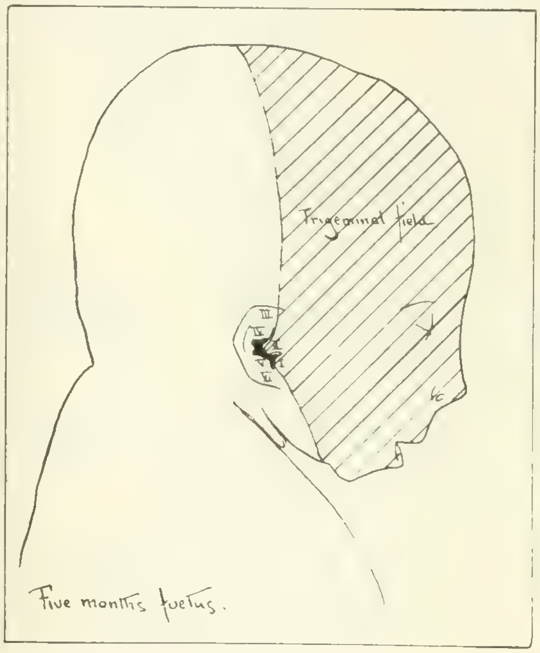

FIG. 29.

The third arch is supplied by the glosso-pharyngeus, the anterior (præ-trematic) branch of which penetrates into the field of the hyoid arch and gives off the Nervus tympanicus, through which afferent fibers supply the mucous-membrane field adjoining the trigeminal area, namely the middle ear, part of the Eustachian tube and pharyngeal wall. Afferent fibers from the skin (somatic) are apparently entirely wanting for this nerve. Its post-trematic branch is the Ramus lingualis.

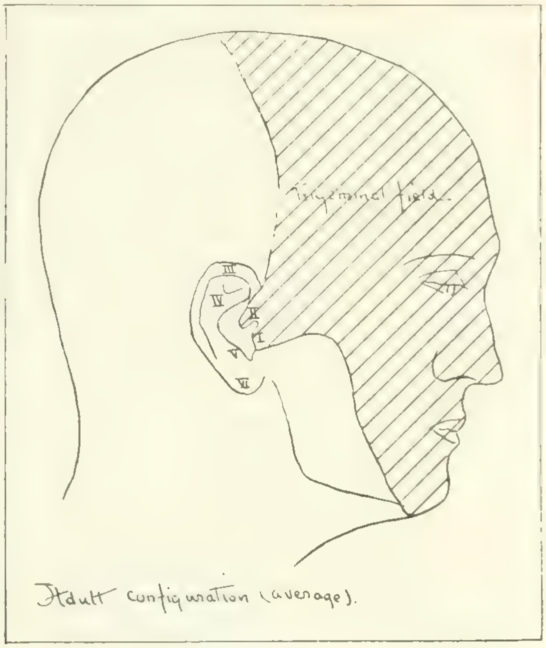

FIG. 30.

FIGS. 26-30.—A series of diagrams schematizing the gradual distortion of the trigeminal skin-field during development into the adult form.

The relationship of the vagus to the succeeding arches is much more complex and less well understood. Its splanchnic field possibly may adjoin the trigeminal mucous membrane field, though one would suppose the fields of the facial or glosso-pharyngeal would completely intervene. Intracranially it is supposed to adjoin the trigeminal field for the dura, since it supplies this membrane in the neighborhood of the foramen magnum. There is no satisfactory explanation for its peculiar cutaneous branch to the external ear, though it may be a rudimentary expression of a large somatic branch found in fishes. The fate of the visceral arches, which disappear in the course of the fifth week, has been discussed by Wm. His in an article on "Die Retromandibularbucht"[19] and in such a way as make easily intelligible the adult disposition of the structures originally pertaining to each of them.

With the exception of the small auricular field of the vagus (?) the next adjoining nerves to the fifth cranial which possess, or at least which retain until adult life, afferent fibers from the skin arise from the cervical cord and hence the question of cutaneous overlap is involved alone with the consideration of this field; the lower cranials on the other hand possess splanchnic afferent fibers so that overlap from the mucous-membrane field necessarily brings into consideration the intervening cranial nerves, namely, the facial, glosso-pharyngeal and vagus.

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[19] Anatomischer Anzeiger, 1886, Bd. I, p. 22.

STEPHEN HALES, THE PHYSIOLOGIST.[1]

By PERCY M. DAWSON, M. D.,

Associate Professor of Physiology, Johns Hopkins University.

A few weeks ago we saw that Stephen Hales was to be regarded not only as a clergyman but also as a philanthropist and a scientist. At that time it was stated that his "contributions to animal physiology were many and important" but that "a discussion of this part of Hales' work would be reserved for another communication."

The account of Hales' work on this subject is contained in the Statical Essays: in the chapter of Vol. I describing the experiments "which show in how great proportion Air is wrought into the composition of animal, vegetable and mineral substances," but chiefly in that part of Vol. II which is entitled "Haemostaticks."

In presenting this subject no attempt has been made to give even a sketch of the whole field of physiology as it appeared to Hales or was affected by his researches. The purpose of the writer being to give some insight into the character rather than into the scope of the work, he has selected certain passages from the "Haemostaticks" and has merely supplemented these quotations with such explanations and comments as have seemed to him needful or appropriate.

"What I had first intended[2] only as additional Observations and Experiments to the first Volume, is now grown to the Size of another Volume, so fruitful are the Works of the great Author of nature in rewarding, by farther Discoveries, the Researches of those *who have pleasure therein:* We can never indeed want for Matter for new Experiments; and tho' the History of Nature as recorded by almost innumerable Experiments, which have been made within the compass of a Century, be very large, yet the Properties of Bodies are so various, and the different Ways by which they may be examined so infinite, that 'tis no wonder that we as yet have got little farther than the Surface of Things: Yet ought we not to be discouraged, for tho' we can never hope to attain to the compleat Knowledge of the Texture, or constituent Frame and Nature of Bodies, yet may we reasonably expect by this Method of Experiments, to make farther and farther Advances abundantly sufficient to reward our Pains.

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[1] Read before the Johns Hopkins Hospital Historical Club, May 11, 1903.

[2] Preface: Haemostaticks, 1733.

"And tho' the Method be tedious, yet our Abilities can proceed no faster; for as the learned author of the *Procedure of human Understanding* observes, pag. 205, 206, 'All the real true Knowledge we have is entirely *experimental,* in so much that, how strange soever the Assertion seems, we may lay it down as the first fundamental and unerring Rule of Physicks, *That it is not within the compass of human Understanding to assign a purely speculative Reason for any one Phenomenon in Nature.*'"

"As the animal Body[3] consists not only of a wonderful texture of solid Parts, but also of a large proportion of Fluids, which are continually circulating and flowing, thro' an inimitable Embroidery of Blood-Vessels, and other inconceivably minute Canals: And as the healthy State of the Animal principally consists, in the maintaining of a due *Equilibrium* between those Solids and Fluids; it has, ever since the important Discovery of the Circulation of the Blood, been looked upon as a Matter well worth the inquiring into, to find the Force and Velocity with which these Fluids are impelled; as a likely means to give a considerable Insight into the animal OEconomy."

"Several ingenious Persons have from time to time, attempted to make Estimates of the Force of the Blood in the Heart and Arteries, who have as widely differed from each other as they have from the Truth, for want of a sufficient Number of *Data* to argue from: Had Persons of their Abilities been more careful, in the first Place to get what Insight they could into the Matter, as far as a regular Series of proper Experiments would have informed them, they would then doubtless have been furnished with more and more proper *Data* whereon to found their Calculations, which would have brought them much nearer to the Truth."

"It may not be improper[4] here to take notice, that being about twenty-seven years since, reading the unsatisfactory conjectures of several, about the cause of muscular motion, it occurred to me, that by fixing tubes to the arteries of live animals, I might find pretty nearly, whether the blood, by its mere hydraulic energy, could have a sufficient force, by dilating the fibres of the acting muscles, and thereby shortening their lengths, to produce the great effects of muscular motion. And hence it was, as I mentioned in the preface to Vol. I, that I was insensibly led on from time to time into this large field of statical and other experiments." How this hydraulic energy was measured is described in the following classical experiments which have given us the Hales manometer.

"In December[5] I caused a *mare* to be tied down alive on her back; she was 14 hands high, and about 14 years of age; had a fistula on her withers, was neither very lean nor yet lusty: having laid open the left crural artery about 3 inches from her belly, I inserted into it a brass pipe whose bore was $\frac{1}{6}$ of an inch in diameter; and to that, by means of another brass pipe which was fitly adapted to it, I fixed a glass tube, of nearly the same diameter, which was 9 feet in length: then untying the ligature on the artery, the blood rose in the tube 8 feet 3 inches perpendicular above the level of the left ventricle of the heart: . . . when it was at its full height, it would rise and fall at and after each pulse 2, 3, or 4 inches; . . . ."

"Then[6] I took away the glass tube, and let the blood from the artery mount up in the open air, when the greatest height of it's jet was not above 2 feet."

"I measured[7] the blood as it run out of the artery, and after each quart was run out, I refixed the glass tube to the artery to see how much the force of the blood was abated; this I repeated to the 8th quart, and then its force being much abated, I applied the glass tube after each pint had flowed out: . . . ."

This experiment was repeated on two other horses and the relation of the blood pressure to the amount of the blood removed was shown in a series of tables. The technique employed by Hales in these experiments is not without interest: "In December[8] I laid a common field gate on the ground, with some straw upon it, on which a white *mare* was cast on her right side, and in that posture bound fast to the gate: . . ." It was of course difficult to keep the manometer in place when the animal struggled and as there was no rubber tubing in those days with which a flexible joint could be made for the pieces of "brass pipe" some other method had to be devised. Accordingly we read that in one of these experiments Hales joined the brass pipe to the glass tube by means of the windpipe of a goose.[9]

A necropsy on one of the horses showed that "There[10] might be about two quarts and three-quarters of blood left in the large veins, which, with what was drawn out at the artery, makes five wine gallons, which at 221 cubick inches to the gallon, amounts to 1105 cubick inches, or 42.2 pounds; which, at a low estimation, may be reckoned the quantity of current blood in the horse; there is, doubtless, considerably more, but it is not easy to determine how much." When these calculations are expressed in modern terms we find that, according to Hales, the total amount of blood in the horse is "doubtless considerably more" than 4.6 to 5.2 per cent. of the body weight while the lethal hemorrhage is about 2.7 per cent. of the body weight.

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[3] Introduction. 1. Hæmostaticks, 1733.

[4] Exp. IX, 23. Hæmostaticks. Where, as in this case, the year of publication is not given it is to be understood that the edition of 1769 is meant. This second edition differs but little from the first except in the less frequent use of capitals.

[5] Exp. I, 1.

[6] Exp. I, 3.

[7] Exp. I, 4.

[8] Exp. III, 1.

[9] Exp. III, 6.

[10] Exp. I, 13.

In one of these horses the pressure in the jugular vein was determined. When the animal was quiet this amounted to only 12 inches but this rose to 52 inches when the animal struggled.[11]

Experiments similar to the above were performed upon other animals namely, a sheep, a doe and twenty dogs, for, says he, "whatever experiment I principally intended to make on any dog, I usually began with fixing a tube first to the jugular vein and then to the carotid artery."[12]

Hales then filled a number of hearts with melted beeswax,[13] then cutting away the tissue, he measured the volume and the superficial area of the casts. With these two factors and knowing the blood pressure, the heart rate, the diameter of the aortic orifice and of the aorta itself, he calculated for horses, oxen, deer, sheep, dogs and man, the mean velocity of the blood in the aorta, the velocity of the systolic output and the total amount of pressure sustained by the heart at the beginning of each contraction. Into all these calculations the capacity or volume of the heart entered as a factor; a factor which, as has been said, Hales determined by the use of melted wax. Now as a matter of fact, the volume of the heart cannot be determined in this or in any other way with any degree of accuracy so that all his calculations are more or less incorrect. But in spite of these inaccuracies we see that Hales had advanced one step beyond Harvey, in that the results of the latter are qualitative whereas those of Hales are quantitative.

That Hales possessed a clear conception of the nature of the blood pressure and of the factors upon which it depends, is readily seen from the following passage. After discussing the rate of the output of the heart he continues: "Now this velocity[14] is only the velocity of the blood at its first entering into the *aorta,* in the time of the *systole;* in consequence of which the blood in the arteries, being forcibly propelled, with an accelerated *impetus,* thereby dilates the canal of the arteries, which begin again to contract at the instant the *systole* ceases: by which curious artifice of nature the blood is carried on to the finer capillaries, with an almost even tenor of velocity, in the same manner as the spouting water of some fire engines is contrived to flow with a more even velocity, notwithstanding the alternate *systoles* and *diastoles* of the rising and falling *embolus* or force . . . ." And again, "For tho' the velocity[15] of the blood at its first entrance into the *aorta,* depends on the proportion the area of its orifice bears to the quantity thrown into it at each *systole,* and also on the number of these *systoles* in a given time: yet the real force of the blood in the arteries, depends on the proportion, which the quantity of the blood thrown out of the left ventricle in a given time, bears to the quantity which can pass thro' the capillary arteries into the veins in that time."

"The force of the blood[16] in the veins and arteries is very different, not only in animals of different species but also in animals of the same kind; and that not only in those of different sizes and weights, but also in dogs of the same size and weight; and even in the same animal the force of the blood in its vessels is continually varying, according to the different kinds and quantities of food, the various distances of the time after taking food, the more or less plethoric state of the blood vessels, also from exercise, rest, different states of vigor or vivacity of the animal, and many other circumstances, which may conduce to vary the force of the blood: for the healthy state of animals is not confined to the scanty limit of one determinate degree of vital vigor in the blood: but the all-wise Framer of these admirable machines has so ordered it, as that their healthy state shall not be disturbed by every little variation in this force, but has made it consistent with a very considerable latitude in the variation of it . . . ."

Hales fully appreciated the difference between lateral and end pressures, for, referring to the fact that the brass pipe was inserted directly into the carotid or crural artery, he remarks, "It may be objected[17] to this method of estimating the force of the blood that by thus fixing tubes in these large veins and arteries, the source of a considerable stream of blood was for the time stopped; and that consequently the force of the blood must be proportionally increased in the veins and arteries." In order to obtain lateral pressures Hales adopted the following ingenious device. He placed the blood vessel between two grooved pieces of wood which were then cemented together and to the vessel by means of warm pitch. One of these pieces of wood had had a hole bored in it. Through this he punctured the vessel and screwing a tube into the hole, he allowed the blood to mount up into it.

That Hales understood the relation of the velocity of the blood to the area of the stream bed; that, in other words, he applied Leonardo da Vinci's law to the circulation is seen in the following. "The arteries[18] continually sending off innumerable branches, the sum of whose orifices is considerably larger than the main stems, hence the velocity of the blood must be proportionately rebated." Nor did he fail to allow for the effect of hydrostatic pressure, for he writes, "when the animal[19] stands on its legs, a column equal to the perpendicular height of the animal, must be added to the several heights of the blood in the glass tubes, in order to estimate the force with which the blood presses against the coats of the blood vessels, at the lower parts of the body, and so in proportion for any other part that is higher."

In the following series of experiments Hales endeavoured to show that the greatest resistance offered to the blood flow is that which occurs in the capillary area.[20] He slit the gut of a freshly killed dog along its greater curvature and running in by way of the aorta "blood-warm" water under a column of pressure (4½ feet) equal to the pressure exerted by the heart, he found that the fluid only oozed out. It required in fact six minutes for 300 cubic inches of the liquid to pass through the gut. He then cut away the guts along the line of their mesenteric attachment and found that the time now required was only two minutes, while on cutting the vessels close to the aorta, the time was still farther reduced to 0.3 minutes or only 0.05 of the time which had originally been required for the same quantity of liquid to pass through the slit gut.

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[11] Exp. III, 2-4, also table on p. 42.

[12] Exp. VII, 1.

[13] Exp. III, 11 &c.

[16] Exp. VII, 2.

Exp. III, 26.

Exp. IX, 13.

[17] Exp. VII, 5.

[18] Exp. VIII, 23.

[19] Exp. VII, 8.

[20] Exp. IX.

The vessels of the slit gut then offer considerable resistance to the flow of blood, but the resistance offered by the gut in the intact animal must be far greater for the following reasons.[21] If 300 cubic inches of blood passed through the intact gut in six minutes, then it may be shown that at each systole one-half of the blood in the heart must pass to the gut. If now we compare the weight of the gut with that of the other blood-containing tissues, we see that the intestine should receive only 1-26 of the heart's output at each systole. In other words the intestine in the living animal offers thirteen times as much resistance to the passage of blood as in the experiment above described. The reasons for this great difference are:[22]

(1) The greater fluidity of water as compared with blood.

(2) The absence of the back pressure of the veins in the one case and its presence in the other.

(3) The greater distensibility of the dead arteries.

(4) In the case of the slit gut the fluid is no longer obliged to pass through the fine capillaries but runs out through the larger vessels which have been severed.

It will be remembered that the origin of these hydraulic and hydrostatical experiments was the desire to know if the blood possessed force enough to bring about the phenomenon of muscular contraction. By subtracting from the pressure in the smaller arteries the pressure in the corresponding veins, Hales obtained a figure which represented the loss of force sustained by the blood in passing through the capillaries. Though the sum total of this force was of course considerable, he found that the amount lost at any one point was entirely inadequate to account for muscular action.[23] Hence he thought that it was to the animal spirits that we must look for an explanation. Not satisfied like so many of his contemporaries with invoking the aid of these hypothetical spirits, and then considering the question solved, Hales suggests that animal spirits may be in some way related to electricity.[24] He therefore tried to demonstrate electrical properties in blood. In this, however, he failed.[25]

One of the most interesting series of experiments undertaken by Hales was that pertaining to the effects of various substances and of water at various temperatures on the calibre of the arterioles or as he calls them "capillary arteries." "I took a young spaniel dog,[26] . . . opened his *thorax* and *abdomen,* and having fixed a glass tube, which was 4 + ½ feet high, to the descending aorta, I then slit open his guts, from end to end . . . . Then having poured blood-warm water on them, and covered them with a folded cloth dipped in the same water, warm water was poured into the tunnel [attached to the tube]; which when it had subsided to a mark on the lower part of the glass tunnel, 18 cubick inches of warm water were immediately poured in, out of a pot which held just that quantity: the time that it was running thro' the fine capillary arteries was measured by a pendulum that beat seconds."

"I first poured in seven pots full of warm water, the first of which passed off in 52 seconds, and the remaining six gradually in less time to the last, which passed in 46 seconds."

"I then poured in five pots of common brandy, or unrectified spirit of malt, the first of which was 68″ in passing, the last 72″."

"I then poured in a pot of warm water which was 54″ in passing."

"Hence we see that brandy contracts the fine capillary arteries of the guts, and that water soon relaxes them again, ..."[27]

A decoction of Peruvian bark[28] contracted the vessels. A decoction of "Chamomel flowers"[29] caused some constriction but not so much as cinnamon-water with which the constriction is very marked indeed. Pyrmont water[30] was also very effective.

Hales considered these experiments to be of importance as indicating the probable action of these substances in the living body "tho' it is not to be imagined,[31] that the effects are so sudden and great in a live animal, as in these experiments; because in a live animal, the several fluids which are taken in, are more gradually and in smaller proportion blended with the blood." "'Tis probable,[32] that such things as constringe the vessels in any degree, do also proportionately increase the force of the arterial blood, and thereby invigorate the animal. But those who much accustom themselves to drink strong spirituous liquors, do thereby destroy the tone of the fibres of their vessels, by having them thus frequently, suddenly contracted, and so soon relaxed again; which makes them like the horse-leech, be ever longing after and thirsting for more and more, thereby to regain again the tensity of their too relaxed fibres.

"After having seen[33] many proofs of the great force of the blood in the arteries, and also in the veins, when an animal exerts its strength; I thought it might not be a useless inquiry to examine the strength of the coats of those vessels."

"I poured[34] into an inverted glass syphon some mercury, so as to have the shortest leg, which was hermetically sealed, filled within four inches of the top; to the other open end of the syphon I fixed, by means of a brass pipe, one end of the right carotid artery of a small spaniel dog, and to the other end of the artery was fixed a condensing syringe. Then placing the artery in water to see whether it leaked, I impelled the air in to such a degree as made the mercury compress the air between it and the sealed top of the tube into so small a compass, as showed by estimation, the force to be equal to a column of water 190 feet high, or equal to the weight of 5.421 atmospheres; with this force the artery burst at once, but no air passed thro' its coats before it burst."

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[21] Exp. IX, 6.

[22] Exp. IX, 7.

[23] Exp. IX, 16.

[24] Exp. IX, 18-19.

[25] Exp. XIII.

[26] Exp. XV, 3-7.

[27] Hales also compared the effect obtained with warm water and with cold pump water. The former flowed readily through the gut requiring only 18 seconds for the passage, while the latter caused a marked constriction and took 80 seconds to pass through the gut.

[28] Exp. XVI.

[29] Exp. XVII.

[30] Exp. XVIII.

[31] Exp. XVIII, 4.

[32] Exp. XVIII, 5.

[33] Exp. XXII, 1.

[34] Exp. XXII, 2.

Experiments similar to the above were repeated on the arteries and veins of various animals. Hales then estimated the normal variations in the blood pressure in both arteries and veins and observed the wide margin which exists between the maximum pressure of the blood and the breaking point of the vascular walls. These results seem to have impressed him very much for he wrote "We see[35] in these instances the great strength of the coats of these vessels; what great reason have we therefore with thankful hearts to say to our Creator, as holy Job did, when he contemplated on the wonderful frame and strength of his body, Job X. 2., *Thou hast* not only *fenced me with bones and sinews,* but hast also effectually secured the vital fluid in such strongly wrought channels, as are proof against its most lively and vigorous sallies, when either agitated by the different passions, or by strong and brisk actions of the body!"

Surprised by the results of his experiments on the strength of the arteries and veins, Hales proceeded to try similar experiments on other tissues. "I took[36] the instep bone of the hinder leg of a calf" fastened one end by a cord to the threshold of a door case, then with an iron bar as a lever attached to the other end pulled the bone apart at the epiphysis. "I found the tenacity and resistance of this joining to be equal to 119 lbs., when the periosteum was removed." It required 550 lbs. to pull apart the bone of the other leg in which the periosteum had not been removed. Subtracting 119 from 550, we get 431 which is then the strength of the periosteum.

"As a force[37] equal to five hundred and fifty pounds was found requisite to separate the above-mentioned joining *symphysis,* so in the growth of the bone lengthwise at that joining nature must exert a like power; not that we are to suppose that the growing fibres are forcibly stretched out at each end, ... But yet the whole sum of the power must be superior to the resistance of all the fibres which connect this juncture."

"I made[38] hydraulic and hydrostatical Experiments not only on the arteries and veins, but also on the intestinal tubes; by affixing, in like manner, tubes of different heights to each end of them, while they were warm.

"I fixed[39] a tube to the gullet of a dog and then poured in water, till the stomach was so full, that the water in the tube stood 36 inches perpendicular height above the stomach; which force burst it lengthwise in its upper part near the pilorus, where it was but $7 + \frac{1}{2}$ inches of circumference: yet no water was impelled through the *pilorus* with this force, though in some other like experiments it has run thro' there into the guts. Another dog's stomach burst in the larger left part of it, when the height of the column of water was but 30 inches."

"On measuring[40] the distention of the stomach in another dog, I found its whole surface equal to 80 square inches, which multiplied into 36, the height of the water in the tube, gives 2880 cubick inches of water, or 104 pounds weight of water, which pressed against the sides of the stomach: and allowing the area of the greatest transverse section of the stomach to be equal to 30 square inches, then the pressure of the water against the fibres of the stomach in that section, when it burst, will be 39 pounds. Which shows how greatly Borelli and Pitcairn were mistaken, when they estimated the force of the fibres of the stomach to be equal to 12,951 pounds; since we may with good reason conclude that the force of those fibres cannot in the live animal be greater than the force which will tear them asunder, as soon as dead. Neither can the pressure of the *diaphragm* and of the muscles of the abdomen on the stomach, be in our utmost straining greater than a weight of mercury two inches deep, and of the breadth of all their areas, as I have shown under Experiment CXVI, Vol. I, p. 270. And that the sum of the compressure of the muscles of the *abdomen* and *diaphragm,* and so also of the stomach on its contents, is not nearly equal to the weight of two inches deep of mercury, is evident from the Appendix,[41] Exper. VII of this Vol. II, where it was found by a mercurial gage fixed in the nose of large pair of smith's bellows, that the most forcible blast of them will scarcely raise mercury two inches high in the gage: And since such a blast of wind is manifestly much greater than the most forcible puff of wind, which is belched out of a distended stomach; it is hence evident, that the stomach, even in that much distended case, does not compress what is contained in it with near that force."

"If we suppose[42] the surface of a full stomach to be equal to 80 square inches, and that its contents are compressed by the action of it, together with that of the *diaphragm,* and the muscles of the *abdomen,* with a force equal to one inch in depth, then the whole pressure on its contents will be equal to 39 pounds, which is nearly the weight of 80 cubick inches of mercury: but as this seems to be too great a force by comparing the velocity with which wind rushes out of bellows, which force is sufficient to raise mercury an inch in the gauge; so I believe half that force, *viz.,* about 20 pounds, would come nearer to the pressure of the aliments in a full stomach."

"Now[43] so small a compressure can have very little effect in promoting the digestion of the aliments: which is therefore with good reason principally attributed to the concurrence of several other causes; such as mastication and comminution with the teeth, and mixture first with *saliva* (which is a leaven full of elastic air), and afterwards with the fluid, which is in plenty separated from the glands of the stomach; . . . . "

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[35] Exp. XXII, 12.

[36] Exp. XXII, 29.

[37] Exp. XXII, 33.

[38] Exp. XXIII, 1.

[39] Exp. XXIII, 2.

[40] Exp. XXIII, 3.

[41] "Appendix containing Observations and Experiments relating to several Subjects in the First Volume."

[42] Exp. XXIII, 4.

[43] Exp. XXIII, 5.

Regarding the function of the lungs[44] Hales was somewhat in doubt, but foremost he placed their refrigerating action. One is accustomed to see this function of the lungs discussed by the older writers in a more or less hazy and indefinite way. Hales, however, carefully calculates, or rather has calculated for him, the exact amount of this refrigeration. Having determined the quantity of blood passing through the lungs per minute, the amount of air breathed during the same time, and finally the difference in the temperature of the inspired and the expired air, he communicated these data to Dr. Desaguliers and Mr. Ch. de Labely. These gentlemen then showed that as much heat is lost in two minutes by way of the lungs as would be required to raise all the blood in the body 0.101928 of a degree, or conversely if one holds his breath for two minutes, "as Gano the trumpeter can," the temperature of his blood will rise 0.101928 of a degree in that time.

When shaken, blood becomes florid, it also becomes florid in passing through the lungs, hence it may be, Hales suggests, that the blood is shaken by the movements of the lungs, but why that should be of any value he was unable to state. He concludes his discussion of the functions of the lungs with the following paragraph: "It is probable[45] also, that the blood may in the lungs receive some other important influences from the air, which is in such great quantities inspired into them. It has long been the subject of inquiry of many, to find of what use it is in respiration, which tho' it may in some respects be known, yet it must be confessed that we are still much in the dark about it."

The "Hæmostatics" is without form or order; in this treatise Hales simply rambles on and on, each experiment suggesting another, so that he was led almost imperceptibly to study a great many physiological phenomena.

The above extracts and abstracts have been given in the hope of imparting some idea of the experimental methods employed by Hales and of the character of the reasoning to which he resorted in his study of animal physiology. The "Haemostaticks," however, contains much more than this. On the title page of Volume II of the Statical Essays stands a quotation from the Instauratio Magna: "True and living natural philosophy upon which the science of medicine is built is a thing to be desired." Having laid a foundation Hales began to build, to apply his physiological lore to medical problems. Hence the "Essays" abound in practical suggestions, some of which are excellent, and in theoretical explanations, most of which are worthless. But one must not criticise him too severely. No one appreciated better than he the proper function of speculation as is shown again and again in his writings. "In natural Philosophy, we cannot depend on any meer Speculations of the Mind; we can only with the Mathematicians, reason with any tolerable Certainty from proper *Data,* such as arise from the united Testimony of many good and credible Experiments."

"Yet[46] it seems not unreasonable on the other hand, tho' not far to indulge, yet to carry our Reasonings a little farther than the plain Evidence of Experiments will warrant; since at the utmost boundaries of those Things which we clearly know, there is a kind of Twilight cast from what we know, on the adjoining Borders of *Terra incognita,* it seems therefore reasonable in some degree to indulge Conjecture there; otherwise we should make very slow Advances in future Discoveries, either by Experiments or Reasoning: For new Experiments and Discoveries do usually owe their first Rise only to lucky Guesses and probable Conjectures, and even Disappointment in these Conjectures, do often lead to the Thing sought for: Thus by observing the Errors and Defects of a first Experiment in any Researches, we are sometimes carried on to such fundamental Experiments, as lead to a large Series of many other useful Experiments and important Discoveries."

The debt which medicine owes to physiology is not so much for its facts as for its methods; and although it was left for another[47] to introduce the method of experiment into medicine, still in the evolution of this method Hales played an important rôle. It is, therefore, because his researches are among the earliest examples of *quantitative* work in the field of animal physiology that they merit our attention and indeed our admiration.

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[44] Exp. XIII, 14.

[45] Exp. XIII, 36.

[46] Introduction: Hæmostaticks, 1733.

[47] François Magendie.

STUDIES IN TYPHOID FEVER.

SERIES I-II-III.

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THE CHEMICAL ORIGIN OF LEUCOCYTES.

By E. Schmoll, M. D.,

Fellow by Courtesy, Johns Hopkins University.

(*From the Clinical Laboratory of the Johns Hopkins University.*)

The Chemical Origin of Cell Nuclei.

In the following experiments I have tried to answer the question whether the organism is able to synthesize the nuclein of its tissue cells, or is obliged to build them out of the cell material contained in its food.

This problem can best be solved by putting a man on a nuclein-free diet. Then, if he is unable to synthesize nuclein for himself, the constant consumption of a certain proportion of the cell constituents would lead to a general diminution in the cells of the body. But it is highly probable that the consumption of the tissue cells and their new formation is a very limited one, a view borne out as well by histological observations as by experiments in metabolism. Hence, it seems to be quite impossible to settle this question by observations on the normal man, and recourse must be had to an organism in which the cell destruction is pathologically increased. The best illustration of increased cell formation and increased cell destruction is seen in leukæmia, in which disease the leucocytes are rapidly destroyed and as rapidly rebuilt. For this reason I have chosen this disease as the subject of my studies. Before I begin a detailed description of my results I should like to give a brief résumé of our present knowledge of the chemical composition of the cell nuclei and their origin.

The proteids of our food and of our body may be divided into three classes—albumin, paranuclein or phosphoglobulin and true nucleins. Albumin forms the chief constituent of protoplasm and is perfectly phosphorus-free. The paranucleins are the secretory products of the same glandular organs; these contain phosphorus and constitute the building material of the growing organism. The two best-known representatives of this group are the casein of the milk and the vitellin of the yolk of the egg. The third group, the nucleins, form the chief constituent of the cell nuclei. They contain phosphorus and show the characteristic atom-complex of nucleic acid, which combined with albumin, constitutes these bodies. Since albumin is abundantly present in all foods, our question resolves itself to the simple form, is the human organism able to form synthetically nucleic acid?

The first example of new formation of nuclein material in this manner was given by Miescher (1) in his too little known work on the life of the Rhine salmon. He was able to demonstrate that the ovary and the testicle, both exceedingly rich cellular organs, are built at the expense of the lateral muscles, one of the tissues poorest in cells, and that the phosphorus necessary for the structure of the cell nuclei is transported in the form of lecithin. The second illustration of such anabolism was given by Kossel (2) and Tichomiroff (3). They were able to prove that eggs did not contain any nuclein bases before incubation, but showed during their extrauterine development a large amount of nuclein bases corresponding to the new formation of cells. Analogously the growing organism, as it was demonstrated by the work of Burian and Schur (4), builds its supply of nuclein and purin bases from milk, which is practically purin-free. The amount of those purin bodies formed was estimated by them by comparing the amount of nucleins in dogs at birth and after they had lived for some time on milk.

These three facts prove that the organism is able to build nuclein from nuclein-free food, and to synthesize its needed cell material in the case of the growing organism; but not whether the adult body is able to perform this synthesis, or has to draw upon its supply in the food for the building of its cell material. To judge the nuclein metabolism in the body and to get a sufficiently clear picture of the changes in the tissues, we have to see if there is any product in the urine which takes its origin exclusively in the nucleins and would allow us to estimate by the amount of its output the breaking down of the cells in the organism. These means are given by the excretion of uric acid. To show the relation between cell material and uric acid output, we must refer to the formation of this body.

Since the investigations of Horbacsewsky (5) and Weinbrand (6) we know that the purin bases contained in the nucleins of the food or of the body have a special influence on the formation of uric acid. They showed that an increased destruction of nucleins occasioned either by an increased breaking down of cell nuclei or by a higher amount of nucleins ingested in food leads to an increased formation of uric acid. That uric acid is a specific oxidation product of nuclein bases was then proven by Hess and Schmoll (7), who were able to show that food influenced the uric acid excretion only when it contained purin bases. Any amount of albuminous substances could be ingested without influence upon the uric acid output so long as these bodies did not contain any purin bases; on the other side, every food which contained purin bodies increased the uric acid output. Those experiments show that the uric acid excretion is caused only by oxidation of purin bases; but they show at the same time that no nuclein synthesis can be proven, and if any takes place the amount built up can only be so small that it does not appear by our methods of metabolism investigation. Then, if on the one hand the uric acid can only be influenced by the oxidation of the purin bases, on the other hand the excretion of the uric acid gives us means to estimate the breaking down of nucleins. A stationary output of uric acid shows that the same amount of nucleins has been oxidized and if following the ingestion of large amounts of albumin or paranucleins there is no increased output of uric acid it shows that no nucleins have been synthesized by the ingestion of those bodies.

A further step was next taken by Burian and Schur (8) to clear the relation of uric acid in metabolism. They showed that the uric acid excretion could be sharply divided into two fractions, the exogenous and the endogenous uric acid. By the conception "exogenous uric acid" they mean that part which arises from oxidation from the purin constituents of the foods, while endogenous corresponds to that part which arises from oxidation of the nucleins of the body, that is, from the breaking down of body cells. The determination of the endogenous part of the uric acid leads us to an estimation of the consumption of the body tissues; its estimation is a very easy one. The organism is for some time placed on a purin-free diet, which, however, covers its need in nitrogen and heat. In this way one obtains a very constant excretion of uric acid, which corresponds to the regular consumption of tissue cells. This is the method which we applied in our work to estimate the cell changes in leukæmia and which combined with the influence of the food on uric acid excretion, leads to the discussion of the question, whether the adult body can synthesize nucleins.

A second way of approaching our problem in the case of the leukæmic patient is afforded by the absolute leucocyte count. An increase would speak in favor of a new formation, a diminution for the destruction. We should expect continued nuclein-poor food to be followed by a diminution, a nuclein-rich diet by a rise, in case the synthetic formation of nuclein material were dependent on the nuclein content of the food. Since the life of a single leucocyte extends over about three weeks, it follows that in each day about five per cent of them are destroyed. Supposing that these were not replaced by new ones, as would be the case if the organism were unable to synthesize the nuclein material, about one-third of the total leucocyte count would be destroyed in a period of six days (the length of time which we chose as periods in our studies). On the other hand, the blood during a nuclein-rich diet would be flooded with new-formed cells.

There is one objection, and a very well-founded one, against the use of this method. We cannot be sure that a drop in the leucocyte count means a destruction and a rise corresponds to a new formation of white blood corpuscles; a variation in the leucocytes very often means only a change in the distribution of the internal and peripheral blood. We sought to diminish the errors caused by those changes, in counting the blood as often as possible under absolutely similar conditions as regards time, food, etc.

In still another way have we tried to control the accuracy of our counts, that is, in comparing the results of the differential count with the absolute number of leucocytes. It stands to reason that a mere change in the distribution of the leucocytes would not influence the differential count. On the other hand, if a rise in the number is accompanied by an augmentation of the cells which are characteristic for the special form of the disease, it seems to indicate an increase and new formation of white cells. Analogously, a catabolism of cells in leukæmia would first destroy the pathological cells as the most available for consumption and a decrease in the count would be followed by a gradual change of the blood picture to the normal.

In the above indicated way have we sought to avoid the errors inherent in the count of leucocytes.

Before, however, we begin the study of the nuclein metabolism in leukæmia, we must know what effect the leukæmia itself has upon metabolism. This question has been the object of very many recent observations by different authors, and their results lead us to the conclusion that we must separate sharply the conditions of metabolism in the two forms of leukæmia, that is, the acute and the chronic. While in the acute leukæmia the destruction of the tissues continues progressively until death and leads to tremendous loss of tissue proteid, in the case of the chronic a totally different condition exists. It is possible, if we except those periods of acute exacerbation of the disease, to so feed the patient that he preserves an equilibrium of albumin metabolism and of body weight, as the work of Magnus-Levy (9), Lowi (10) and others have shown. The most marked anomaly which chronic leukæmia shows was discovered a long time ago before the connection between nuclear destruction and uric acid excretion was recognized, that is, an increase in the uric acid output, which Bartels (11) showed in the case he published, in which the excreted amount was nearly three grammes per day. This fact was confirmed by many others, and Magnus-Levy (12) has even published a case in which the uric acid reached the record point of eight grammes in twenty-four hours. There are, of course, some cases in which this anomaly is much less marked. It stands to reason that the uric acid output is only an indication of the amount of white corpuscles destroyed in metabolism. If this amount is a very limited one, as may occur in cases with a low leucocyte count (see our case P.), or even in cases with a high number of white corpuscles but a limited destruction, then, of course, the output of uric acid is only a bit above normal or even normal.

A second product of increased cell destruction we must consider are the xanthin bases. Their relation has recently been the subject of careful study with the result that their excretion in general is increased above the normal. The interesting fact has been brought forth in several cases that in the amount of uric acid and of the xanthin bases excretion there is a certain amount of antagonism; that is, when the amount of uric acid diminishes that of the xanthin bases rises, and the reverse; while the sum of these amounts is fairly constant. For some time it has been a question whether in leukæmia the ability to destroy the xanthin bases is diminished or entirely stopped. Experiments performed by Bondsynski and Gottlieb (13), as well as those of Schmid, were undertaken in this connection. They fed methylated xanthin bases, that is, theobromine, caffein, etc., and showed that these bodies are as completely oxidized in the leukæmic as in the normal body.

To review, we see that in the case of a chronic leukæmic patient the following conditions obtain: The body on a sufficient diet is kept in equilibrium as regards nitrogen and body weight; the uric acid excretion is commonly increased corresponding to the increased leucocyte destruction, while in other cases, in which the destruction is within normal limits, the uric acid excretion is also normal.

A case of lymphatic leukæmia and one of the myelogenous variety, both chronic cases, were studied. Both were in the period of intermission with a very low count of leucocytes; in the lymphatic patient about 50,000; in the myelogenous, 10,000. In the first case I made continuous observations on the composition of the urine and used the second more as a control, since, on account of his low leucocyte count, a pathological metabolism of the purin bodies could not be expected. Concerning the methods used, I would say that the patient received a carefully-weighed diet. The urine was quantitatively collected each morning and examined while fresh. The total nitrogen was examined by the Kehldahl method, the uric acid according to the Ludwig-Salowski, and with the modification that the amount of uric acid was not determined gravimetrically, but by its nitrogen content. The purin bases were estimated according to Arnstein-Kamerer, and the phosphoric acid by trituration with uranium nitrate.

John C. W——, 46 years old. At the first admission in January, 1903, he complained of swelling in neck, axilla and groins. He had malaria about eight years ago, but without chills; grippe about four years ago. About fourteen years ago he was bruised on the left side just below the ribs by getting crushed while making a coupling as a brakeman on the railroad. He was, however, not injured enough to prevent his working. He first noticed a swelling under the right and left sides of the jaw about four years ago. During the last year several nodules appeared in the neck, axilla and groins, growing very rapidly in size; he never noticed, however, an increase in the size of the abdomen. On admission an enlargement of the glands of neck, axilla, groins and the perineum was found. The spleen attained a very considerable volume, descending far below the navel. An examination of the blood showed the following proportion of different leucocytes:

Polymorphonuclear neutrophiles	7.6%
Small mononuclears	84.9%
Large mononuclears	5.5%
Transitional forms	0.5%
Polynuclear eosinophiles	0.5%
Mastcells	0.8%
Myelocytes	0.2%

4 normoblasts.

The number of red blood corpuscles amounted to 2,916,000; hæmoglobin, 59 per cent; leucocytes, 41,600.

On the second admission, in November, 1903, there was no noticeable change in his general condition. In April he injured the left big toe and developed a blood poisoning, for which he was operated on in a neighboring hospital. After a large incision and removal of much necrosed tissue, he seemed well, but a month afterward he had a suppuration in his right thigh; after incision 1½ pints of pus were removed. During the last week before entering the hospital he had a swelling of the feet. During the whole time he has taken Fowler's solution.

On entering the hospital his condition was as follows: glands about the same size as on last admission; spleen rather larger, reaching the symphysis.

The examination of his blood showed the following results:

Red blood corpuscles	3,204,000
Hæmoglobin	54%
White blood corpuscles	25,450

Differential count:

Small and large lymphocytes	66.5
Polymorphonuclears	26
Eosinophiles and Mastcells	0.5
Transitionals	1.0
Myelocytes	1.2

1 nucleated red.

The time of the investigations began Nov. 25, and was divided into four periods. During the first period the patient received a mixed diet, consisting of eggs, albumin, milk, bread, meat and vegetables, a diet as similar as possible to that to which he was accustomed. Excluding certain items and increasing the milk, the patient in the second period received a practically purin-free diet, consisting of milk, eggs and bread. This diet was continued for six days. Then the former diet was resumed in the third period. It consisted of the previously given amount of milk, eggs and bread, together with from four to five hundred grammes of meat in order that an appreciable increase in the uric acid and purin bases might be obtained. During the fourth period thymus was substituted for the meat. Hence, this diet was eminently rich in nucleins. Of course, it was not possible that the patient should receive every day exactly the same amount of food, and hence he was allowed to eat as much of the menu as he wished, and the unconsumed food was again weighed and subtracted. I have not determined the amount of nitrogen in the food, since for our purpose it was not of very much moment, but have tried to keep the heat value fairly constant. The results obtained are the following:

1st Period, Nov. 25. Leucocytes, 23,500.

Lymphoc. small and large	76%
Polymorphonuclears	21%
Eosin. and Mastcells	1%
Transitionals	1%
Myelocytes	2%

Nov. 27. Hæmoglobin, 49%. W. B. C., 29,000.

Lymphoc. small and large	71.3
Polymorphonuclears	27.5
Eosinophiles and Myeloc.	1.2

2d Period, Nov. 29. R. B. C., 3,420,000. Hb., 52%. W. B. C., 44,600.

Small Lymph.	72%
Polymorphonuclears	22%
Large mononuclears	3%
Myeloc.	1%
Eosinophiles and Mastcells	2%

No nucleated reds.

Dec. 2. W. B. C., 39,500. Hb., 58%.

Small Lymphoc.	68%
Polymorpho. Neut.	25%
Large Mononucl. and Trans.	5%
Myeloc.	1%

No nucleated reds.

Dec. 4.

Small Mononucl.	75.9%
Large Mononucl. and Trans.	1.6%
Eosinophiles	78%
Polym. Neut.	18%
Mastcells	0.2%
Myeloc.	3.6%
Normoblasts	3 in 1000

3d Period, Dec. 6. W. B. C., 45,000. Hb., 56%.

Small Lymphoc.	82%
Large Lymphoc.	3%
Polymorphonuclears	14%
Myelocytes	1%

Dec. 7.

Small Lymph.	80.5%
Large Lymph.	3.3%
Polymorphonuclears	14.2%
Myeloc.	2%

Dec. 8. R. B. C., 4,444,000. W. B. C., 91,300. Hb., 60%.

Small Lymphoc.	80.5%
Large Lymphoc.	3%
Polymorph. Neut.	13.8%
Myeloc.	2.5%

Dec. 9. R. B. C., 3,552,000. W. B. C., 70,800. Hb., 58%.

Dec. 11. W. B. C., 66,000. Hb., 62%.

Small Lymphoc.	63.2%
Large Lymphoc.	4.0%
Polymorph. Neut.	20.5%
Eosinophiles	0.5%
Myeloc.	4.5%
Mastcells	1.3%

4th Period, Dec. 13. W. B. C., 56,400.

Dec. 15. R. B. C., 3,448,000. W. B. C., 76,800. Hb., 52%.

Small Lymphoc	87%
Large Lymphoc and Trans.	3%
Polym. Neut.	8%
Myeloc.	3%
Mastcells	0.2%

Normoblasts, 5 in 500 counted.

Dec. 16.

Polym.	10.8%
Mononuclears	87.8%
Large and Trans. Mononuc.	0.6%
Eosinophiles	0.4%
Myeloc.	0.4%

Average of the Four Periods.

I Period. R. B. C., 3,204,000. Hb., 54%. W. B. C., 26,250.

Large and Small Mononucl. and Trans.	73.3%
Polynuclear Neut.	24.8%
Eosin. and Mastcells	0.7%
Myeloc.	1.2%

II Period. R. B. C., 3,420,000. Hb., 55%. W. B. C., 41,500.

Large and Small Mononucls. and Trans.	75.2%
Polynuclear Neut.	21.7%
Eosin. and Mastcells	1.0%
Myeloc.	2.1%

III Period. R. B. C., 3,998,000. Hb., 60%. W. B. C., 68,800.

Large and Small Mononucls. and Trans.	79.8%
Polynuclear Neut.	18.6%
Eosin. and Mastcells	1.0%
Myeloc.	3.6%

IV Period. R. B. C., 3,448,000. Hb., 52%. W. B. C., 56,600.

Large and Small Mononucls. and Trans.	89.2%
Polynuclears Neut.	9.4%
Eosin. and Mastcells	0.3%
Myeloc.	1.1%

		Urine.	Sp. Gr.	N.	Ur. Ac.	All. N.	All. Bas. N.	P_2O_5	Diet.
Nov.	25	670	1028	9.623	0.516	0.274	0.102	1.889	Mixed.
"	26	650	1026	9.10	0.541	0.243	0.062	1 50	"
"	27	610	1027	9.65	0.589	0.239	0.043	0.853	"
"	28	610	1022	8.796	0.056	0.171	0.152	1.81	Milk & eggs.
					0.576	0.348			
"	29	1660	1019	20.467	1.095	0.525	0.160	4.84	"
"	30	840	1025	13.148	0.566	0.292	0.103	3.888	"
Dec.	1	1150	1025	18.899	0.554	0.328	0.143	4.945	"
"	2	830	1026	14.711	0.474	0.295	0.137	3.345	"
"	3	1100	1025	18.541	0.517	0.245	0.066	3.41	"
"	5	1320	1024	25.275	0.765	0.303	0.048	5.078	Meat.
"	6	1010	1023	18.523	0.373	0.144	0.02	2.97	"
"	8	1000	1023	19.315	0.602	0.23	0.03	3.80	"
"	9	1150	1026	23.313	0.77	.. .	....	4.54	"
"	10	1140	1029	22.407	0.88	0.392	0.098	4.43	"
"	11	990	1023	14.108	0.42	0.22	0.08	2.74	"
"	12	1520	1026	27.914	0.984	0.433	0.104	4.894	Sweet bread.
"	13	1290	1025	23.308	1.175	0.588	0.196	5.585	"
"	14	1020	1024	18.107	1.01	0.469	0.099	3.81	"
"	15	1020	1024	17.478	1.141	0.532	0.152	4.794	"

	1st Per.	2d Per.	3d Per.	4th Per.
N.	9.149	15.760	20.49	21.652
Ur. Ac.	0.547	0.544	0.635	0.078
Pur. f.	0.252	0.309	0.258	0.505
Alb. con.	0.069	0.132	0.055	0.138

DIET.

Nov. 25, 6 eggs, egg albumin, 250 gr. meat, vegetables, mild, bread.

												Cal.
"	26											
"	27											
"	28	Milk,	2150	Eggs,	9	Bread	50					2150
"	29	"	3200	"	8							2790
"	30	"	3200	"	7							2790
Dec.	1	"	2800	"	8							2118
"	2	"	3200	"	8							2790
"	3	"	3200	"	6							2790
"	5	"	1500	"	5	Meat	500,	Bread	200,	Butter	70	2697
"	6	"	2100	"	4	"	390	"	....	"	60	2793
"	8	"	1500	"	5	"	500	"	200	"	70	2745
"	9	"	1300	"	4	"	380	"	200	"	50	2147
"	10	"	1500	"	5	"	500	"	200	"	50	2543
"	11	"	1700	"	4	"	470	"	200	"	10	2011
"	12	"	1700	"	4	Sweet br.	420	"	200	"	50	2865
"	13	"	1700	"	4	"	380	"	200	"	50	2657
"	14	"	1700	"	4	"	480	"	200	"	50	2827
"	15	"	1700	"	4	"	360	"	200	"	50	2493

I would like to make a few observations concerning this case of leukæmia, and the changes in the blood picture which were observed during his stay in the hospital.

From the general picture of the case there can be no doubt that it was a case of chronic lymphatic leukæmia, but with some unusual features. There can be little doubt that the large spleen, which practically occupied the whole abdomen, is a very rare event in the history of those cases. Analogous cases have been described by Pappenheim (15), but seem to be very rare. In our case the enlarged spleen was combined with myelocytes, which reached during his stay in the hospital a percentage of about 3½ per cent. Dr. Simon kindly communicated to me the different counts, which he made during the disease before admission to the hospital; they showed that at the beginning there were none, but about one year ago the myelocytes appeared in the blood picture and have increased since. There can be no doubt that the case, being at the beginning a regular case of lymphatic leukæmia, has presented since some features of the myelogenous type and is to be looked upon as a mixed case.

Concerning the changes in the total count and in the differential count, the following may be said: there can be little doubt that during the course of the experiment the condition of the case became worse. This is shown by the increase in the leucocyte count, and by the increase in the mononuclear cells relative to the polynuclear cells. We believe this is due to the new formation of these cells. This increase involved the total number of the leucocytes, as well as of the lymphocytes and the other cells arising in the bone marrow, the myelocytes.

I will now give a short history of the second case studied, a case belonging to the myelogenous group.

David P——, 29 years of age; complains of weakness. The disease began with a heatstroke three years ago; he felt weak for about three months, fainted nearly every day. Since then he was not able to attend to hard work. The enlargement of the spleen was first noticed about a year ago. On examination nothing pathological was found, with the exception of a tumor of the spleen, which reached nearly to the symphysis and extended to the right, a little beyond the navel. R. B. C., 3,329,000. W. B. C., 443,000. Hb., 49.

Myelocytes	64.2%
Polymorph. Neut.	31.6%
Mastcells	2.0%
Eosinophiles	0.56%
Large Mononcls.	0.18%
Small Mononcls.	0.18%
Nucleated red	1.1%
Normoblasts	0.55%
Megaloblasts	0.30%
Transitionals	0.19%

After having been in the hospital one month, he took Fowler's solution for about ten months. On second admission, Dec. 7, 1903, the spleen was considerably reduced in volume, reached median line at the navel, stopped at the ant. sup. spine.

Blood. 3,072,000 R. B. C. 9,700 W. B. C. 51% Hæmoglobin.

Differential blood count:

Polym. Neut.	73.7%
Trans. and Large Mononucls	3.2%
Small Mononucls.	4.9%
Eosinophiles	4.5%
Myeloc.	4.7%
Mastcells	9%

In this patient analogous observations were made, as in the previous case, in order by changes of diet to cause changes in the blood picture. In this case so much attention was not paid to the urine, since, because of the very slight number of leucocytes, a change in the nuclein metabolism was scarcely to be expected. I made a sufficient number of analyses to justify this opinion, as, for example, the uric acid excretion on the 12th of December, the amount of urine being 1120 c. c. and the nitrogen output 12.1 grammes, was only .17 gramme.

First period. The patient received during this period a purin-free diet consisting of milk, eggs and of 100 grammes of bread.

Diet.	Dec. 8	Milk, 3200	Eggs, 8
	" 9	" 3200	" 8
	" 10	" 3200	" 8
	" 11	" 2400	" 5
	" 12	" 3600	" 8

During this period the blood showed the following conditions:

Dec. 9	W. B. C., 7,200
" 10	" 8,600
" 12	" 6,000

Differential count:

Polym. Neut.		70.8%
Large Mononucls. and Trans		3.6%
Small Mononucls.		3.8%
Eosinophiles		3.8%
Mastcells		7.6%
Myeloc.		8.0%
Doubtful cells (approach Mastcells)		2.4%
Nucleated reds,	Normoblasts	11
	Transitionals	7
	Megalobl.	2

Average:

Leuc.	8,800
Polym. Neut.	72.2%
Trans. and Mononucls. Large	3.4%
Small Mononucls.	3.4%
Eosinophiles	4.1%
Myeloc.	6.5%
Mastcells	8.4%
	100%

During the second period a part of the milk was exchanged for thymus and so an extremely purin-rich food was obtained.

Diet II.	Milk	Bread	Butter	Eggs	Sweetbread
Dec. 13	1900	200 gr.	50 gr.	4	375 gr.
Dec. 14	1100	200	40	3	475
Dec. 15	1600	200	50	4	450
Dec. 16	1600	200	50	4	430
Dec. 17	1500	200	50	4	460
Dec. 18	1600	200	50	4	380

The blood composition was as follows:

Dec. 14. W. B. C. 15,600.

Polym. Neut.	53.1%
Large Mononucls. and Trans	3.5%
Small Mononucls.	5.2%
Eosinophiles	1.5%
Myeloc.	25.4%
Mastcells	8.2%
Doubtful	2.5%

Dec. 15. W. B. C. 10,100.

Differential count:

Small Mononucls.	5.0%
Large Mononucls. and Trans	4.2%

Polym. Neut.	40.6%
Eosinophiles	6.6%
Myeloc.	26.9%
Mastcells	16.3%

Dec. 17.

R. B. C.	3,616,000
W. B. C.	10,400
Hæmoglobin	62%

Dec. 19.

W. B. C.	12,600
Polym. Neut.	35.5%
Large Mononucls. and Trans.	3.2%
Small Mononucls.	7.6%
Eosinophiles	1.4%
Myeloc.	45.1%
Mastcells	7.4%
Normoblasts	6

Average:

W. B. C.	12,200
Polym. Neut.	43.3%
Large Mononucls. and Trans.	3.6%
Small Mononucls.	5.9%
Eosinophiles	3.2%
Myeloc.	32.4%
Mastcells	11.5%
	99.9%

During the third period the patient received the ordinary ward diet with a daily amount of 500 grs. of meat. The count at the end of the third period was as follows:

R. B. C.	4,016,000
W. B. C.	100,000
Hb.	62.0%

Differential count:

Polym. Neut.	46.8%
Trans.	14.2%
Myeloc.	26.6%
Eosinophiles	0.9%
Mastcells	6.5%
Lymphocytes	1.3%
Large Lymphocytes	3.7%
	100.0%

2 normoblast and 1 megaloblast.

In this case we were dealing with one of typical myelogenous leukæmia in a stage of remission. The number of leucocytes exceeded the normal either not at all or only slightly, and yet the blood picture was unquestionably that of myelogenous leukæmia. The high percentage of myelocytes and among these of the eosinophile myelocytes, of which there were a goodly number, the large number of Mastzellen, and the numerous megaloblasts, left no doubt concerning the nature of the process underlying these blood changes. Such intermissions in the course of leukæmia are not very rare and during the last years many have been reported. We received the impression that the continued use of arsenic in this case explains in part at least the improvement of his condition.

Consideration of the influence of changes in diet on the leucocyte count in both observed cases shows that the blood picture changes decidedly for the worse following the change in diet. In both cases the differential count shows considerable increase in the number of those cells characteristic of the special form of the disease. For instance, in case W. are seen the following relations:

Period		Leuc.	Lymphocytes
1	Mix. norm. diet	26,500	73.3%
2	Purin-free, albumin-rich diet	41,500	75.2%
3	Mixed purin, albumin-rich	68,300	79.8%
4	Purin-rich and albumin-rich	66,600	89.2%

In case P. the changes produced were as follows:

Period		Leucocytes	Myeloc.	Mast
1	Purin-free	8,800	6.5%	8.4%
2	Purin-rich	12,200	32.5%	11.5%
3	Purin-poor	100,000	26.6%	6.5%

A consideration of these tables leaves no doubt in our minds that as a result of an albumin-rich diet, the number of leucocytes is increased. Differential counts show an accentuation of the pathological blood picture. But one might object that the changes in the peripheral blood picture would hardly allow us to draw conclusions concerning the general composition of the blood. Such an objection has surely some foundation. Its weight is, however, not great, since each figure is the average of several counts and in both cases the influence of the diet had a parallel effect on the blood count and on the morphological changes of the blood picture, and both of these elements indicate that the patient is getting worse. If we seek to determine which factor in the nourishment is responsible for the above, we must conclude that a definite relation exists between the composition of the diet and the relation of the leucocytes. An albumin-rich diet acts as a stimulus to the formation of leuocytes. An increase in the amount of albumin results in an increase in the number of the white blood corpuscles. The particular kind of albumin seems to have no particular influence on this new formation, for when a normal mixed diet in Period 1 was replaced by an albumin-rich but purin-free diet, the leucocytes rose from 26,500 to 46,500. Following the transition from albumin-rich, purin-poor diet, Period 3, to a purin-rich diet there followed a fall from 68,300 to 66,600. In case 1 the transition from purin-rich diet, Period 2, to the purin-poor but albumin-rich diet, Period 3, was followed by a rise from 12,200 to 100,000.

Hence, the clinical observation does not speak in favor of a connection between the sort of albumin and the nuclear formation since he is able from any albumin-containing material to obtain the material for the new formation of nuclei. This view is corroborated by the observation of the metabolism in Case W. I would like here to give a short résumé of the results which we have obtained in this case:

Period		N	Uric acid	Purin N
1	Mixed diet	9.49	0.54	0.25
2	Purin-free	15.76	0.54	0.30
3	Albumin-rich, purin-poor	20.49	0.63	0.26
4	Purin-rich	21.62	1.08	0.51

What conclusions may we draw from these figures? The endogenous fraction, determined by the method of Burian and Schur, amounted in Period II to 0.54 grammes per day.

In adding to the purin-free food in Periods I and III moderate amounts of nucleins in the food, we do not obtain a rise in the excretion of uric acid and the purin bases. How is it to be explained? In our opinion hardly any doubt can arise that the amount varying in the three periods between 0.54 to 0.61 gr. per day is principally due to the breaking down of the leucocytes. To build the material for the new formation the organ uses the nucleins, if there are any present in its food; if not, he uses the other proteids to synthesize those bodies. Therefore the amount of broken-down nuclein material is fairly constant, while its origin is different. The organism prefers to draw upon preformed nuclein material; but if it is not able to get it, it is perfectly able to synthesize it.

The amount of synthesized nuclein can be estimated by the difference in the output of uric acid. In the first period we should have, according to Burian and Schur, an increase of 0.15 gr., in the third period of 0.30 gr. above the endogenous fraction of 0.54 gr.

In period IV the nuclein material in the diet more than covered the requirements of the organism and there occurred an increased output of uric acid corresponding to the increased supply. In any case this period confirms our belief that the organism had no tendency to store up nuclein material, but that the amount over and above its needs was oxidized and excreted.

Also from these figures we may conclude that the organism builds up its cells from any albuminous material furnished in the diet, and that it is able to cover its needs in nuclein from any albumin.

My results are confirmed and illustrated by three facts I have been able to find in literature.

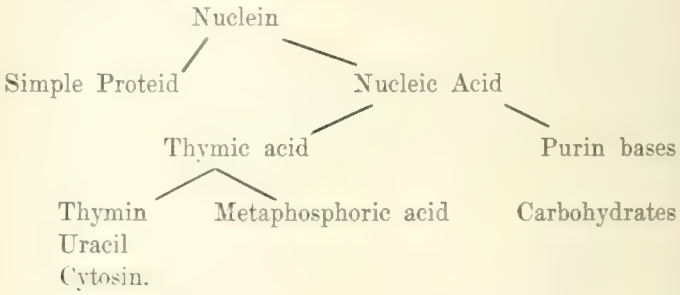
The first one, which approaches most the technique of my work, is contained in the report of Van der Wey (16). He fed to a leukæmic patient for a period of 22 days a diet entirely free from purin bodies. The leucocyte count during the experiment varied between 175,000 to 295,000; and the average of the uric acid output was 1.36 gr. The case would be an absolute proof for the formation of nucleins out of nuclein-free bodies, if the organism had kept its body weight and its nitrogen equilibrium, but during the duration of the experiment the body lost about 91 gr. of N. and 3.1 Kos. in weight. So, the objection may be raised that the nucleins destroyed in metabolism were formed from the tissue nucleins. It does not seem very probable because the amount of destroyed nuclein is much larger than would correspond to the amount of broken-down tissue cells.

An absolute proof for the synthetic formation is given by the work of Socin (17). He was able to feed mice on a purin-free diet (yolk of an egg) for an indefinite time. Therefore it is sure that those animals have synthesized the new-formed nuclei out of a purin-free diet.

In a very similar way the synthesis of nucleins is proven by the observation of Hausermann (18). He described the case of a young man 18 years old who had lived his whole life on milk and bread. He was normally developed and did not present any pathological features with the exception of a slight anæmia (hæmoglobin, 60 per cent). This case proves without discussion the possibility of the synthetic formation of nucleins.

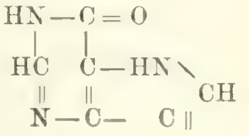
How shall we account for the synthesis of nucleins from the chemical standpoint? Nuclein consists of albumin and nucleic acid. Since albumin is abundantly present in all foods, our question resolves itself to the simple form, is the human organism able to form synthetically nucleinic acid? A closer consideration of the composition of this acid will permit us to get a clearer view of this question. The result of the splitting up of nucleinic acid gives us on the one side the four purin bases, adenin, guanin, xanthin and hypoxanthin; and on the other side, thymic acid. This latter yields by further cleavage, according to its origin, cytosin or thymin or uracil, together with metaphosphoric acid and carbohydrates, which may belong either to the hexoses or pentoses.

A graphic representation of the cleavage of the nuclein is attempted in the following diagram:

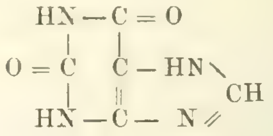


Now it is without question evident that the organism can obtain from its food an abundance of metaphosphoric acid, carbohydrates and albumin. For this synthetic formation of nucleic acid it needs only the purin bases and the uracil group.

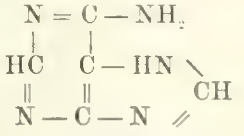
To consider first the purin bases: these are all to be looked upon as derivatives of purin.



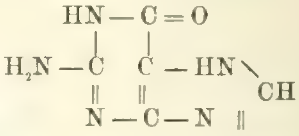
Hypoxanthine = 6 oxypurine



Xanthin = 2-6 oxypurine

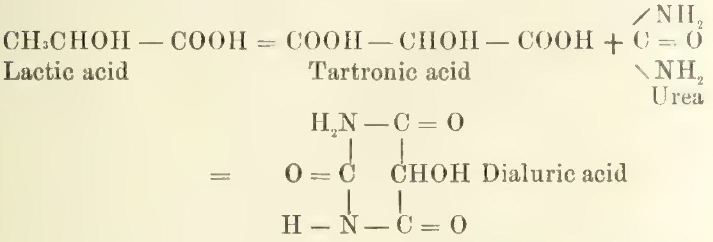


Adenine = 6 amniopurine



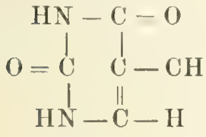
Guanine = 2 amino 6 oxypurine

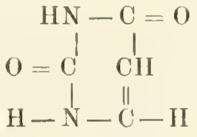
The question whether this purin ring can be synthetically built in the body is a very old one and one some time ago answered by Minkowski (19) in the affirmative, who demonstrated that in the case of birds the purin ring is synthesized from lactic acid and ammonia. He showed that after the extirpation of the liver, birds excrete instead of uric acid ammonia and lactic acid, a synthesis which is perfectly analogous to Horbacsewsky's (20) artificial synthesis from trichlorlactic acid. This question was further considered by Wiener (21), who demonstrated that in the case of birds all dibasic acids with a chain of three carbon atoms, if administered simultaneously with urea, can form uric acid. The most efficient of these acids was tartronic acid and its ureid, dialuric acid, and only these two bodies could be transformed to uric acid by the isolated organs. Since, however, in the case of extirpation of the liver, an animal excretes not these acids, but lactic acid, we must suppose that lactic acid is oxidized to tartronic acid before the formation of uric acid, which combined with urea yields dialuric acid.

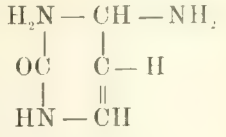


This dialuric acid then enters into a further combination with urea and forms uric acid. Based on these observations, Wiener then attempted to demonstrate the synthetic formation of uric acid in the case of mammals in feeding dibasic acids with a chain of three carbon atoms, but the increase in the excretion of uric acid was so slight that the difference was within the limits of experimental error. We cannot admit that in the case of man the synthetic formation of purin was proven by these experiments. We must conclude, therefore, that for man the synthetic formation of the simple purin ring has not yet been proven.

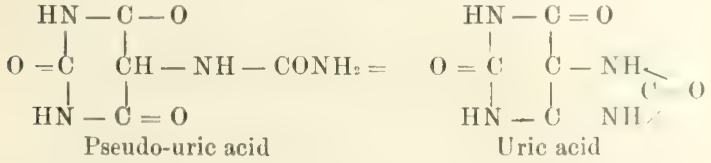
If we consider the other constituents of nucleinic acid, namely, thymic acid, we find that its cleavage products are cytosin, thymin and uracil. Concerning these, the investigations of the Kossel school have demonstrated the remarkable fact that all three bodies are to be considered as derivatives of the pyrimidin ring. The graphic formulæ of these products are as follows:


Thymin

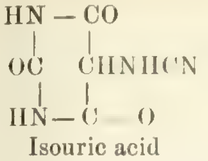

Uracil

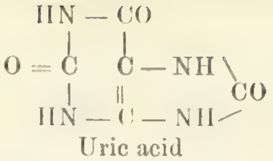

Cytosin

The pyrimidin derivatives are characterized by the remarkable ease with which they unite with the urea molecule and thus form derivatives of the purin ring, as is proved by the following synthesis of uric acid. The pseudo-uric acid is converted into uric acid by fusion with oxalic acid.

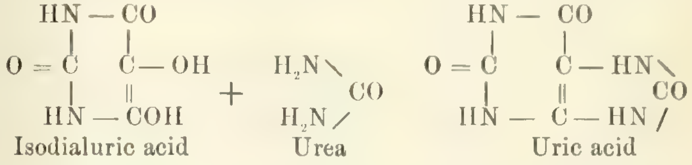


In like manner, isouric acid yields uric acid if boiled with hydrochloric acid.


Isouric acid


Uric acid

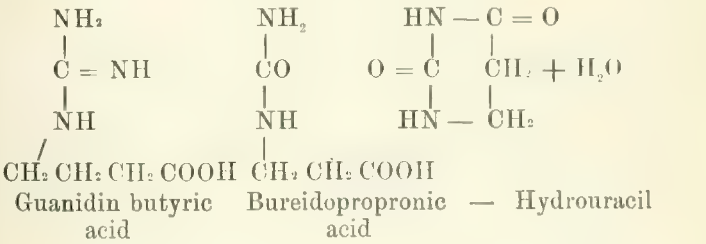
Analogously, Behrend and Rogsen have formed uric acid from isodialuric acid and urea.



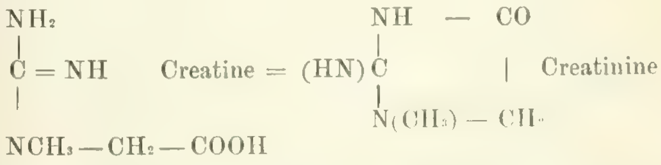
We have already mentioned the dialuric acid in connection with Wiener's work. He was able to demonstrate in the case of birds that this acid forms uric acid by synthesis with urea.

The question, therefore, of the synthetic formation of nucleinic acid resolves itself to the simple question whether the organism obtains its pyrimidinring by synthesis or whether it gets it preformed in the food, for there is no doubt that the organism can form the purin ring in case the pyrimidin ring is present. For the experimental proof of this conception, however, has Steudel given us no positive data; but the fact the pyrimidin derivatives given per os are not transformed into uric acid hardly proves that pyrimidin formed in metabolism is not used for the further formation of purin bodies. Then that the organism is able to build new products by synthesis with urea is abundantly proven by the formation of taurin, sarcosin, etc. The possibility of the synthetic formation of the pyrimidin ring is proven by several different reactions. As we have previously mentioned, lactic acid is oxidized to tartronic acid, which in turn combines with urea to form dialuric acid in which is present the pyrimidinring.

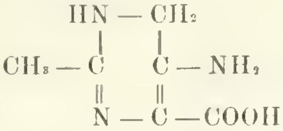
In like manner, β-ureidopropronic acid, the analogue of which, the guanidin butyric acid, Kutscher proved to originate from arginine, yields by hydrolysis uracil:



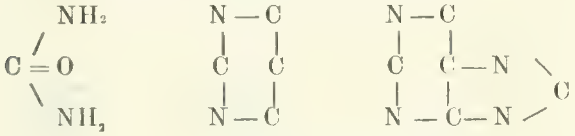
This process is perfectly analogous to the formation of creatinin from creatin.



We may say, therefore, that the possibility of the synthetic formation of the pyrimidin ring from amino acids is to be granted. But the organism does not even need the formation of the pyrimidin ring, since the same is furnished in the albumin. The important observations of Fraenkel (22) concerning the constitution of histidin, which is present in each albumin body, have proven to us that this is to be considered as a derivative of pyrimidin, and probably is represented by the following formula:


Histidin

The organism, therefore, has at its disposal in any case the pyrimidin ring to build up the purin ring, and from this nucleinic acid and the nucleins. The simple relation of these bodies is best evidenced by the following scheme:


Urea Pyrimidin Purin

To review the preceding considerations, therefore, we see that the organism is always able by simple chemical processes to form the building stones of nucleic acid. That those are united and utilized for the building of the cell material we have been able to show in our preceding experiments.

The two cases, which we had at our disposal for decision of the question which we tried to answer, were not the most favorable ones. In both the number of leucocytes was not very high and in both also the destruction, judged by the uric acid output, was not very great. I intend to resume those investigations on nucleinic metabolism, should any more favorable cases present themselves.

Discussion.

Dr. Emerson.—This contribution of Dr. Schmoll's to our knowledge of the chemical origin of leucocytes deserves our careful attention. In the first place, there are few who can speak with greater authority concerning uric acid and the allied bodies, a subject which enters largely into the present question, than can he, for his earlier work on this subject is quite classical; it suggested and made possible the well-known work of Minkowski, and was recently described by Wiener as "brilliant."

In the second place, the present work is a very ingenious method of attacking an interesting subject; where does the adult body get the materials for the nuclei of its leucocytes? does it synthesize them, or borrow them directly from its food? Dr. Schmoll follows the purin ring. In the case of those containing this ring there is no doubt that the young bird and the young mammal can synthesize them. Can the adult man as well? Dr. Schmoll places the adult leukæmic on the diet of the young bird and infant, a purin-free diet, and follows the leucocyte count and uric acid output.

Unfortunately, the cases of leukæmia at his disposal were not very suitable cases; that is, had a low count and low output of uric acid. Nevertheless, the results are all in the right direction and we feel confident that further work will confirm them.

But the best part of the work is its suggestiveness, for this line can be followed in other directions, with, I am sure, interesting results.

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MENTAL PHENOMENA AND VISCERAL DISEASE.[1]

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We are all more or less familiar with the mental changes that at times take place in different pathological conditions. These may be due: (1) To changes in the blood in cardiac disease, or to vascular degeneration. (2) To poisoning resulting from disease of certain organs, as, for example, the kidney or the liver. (3) To the effects of alcohol and like poisons, either in acute or chronic form, by themselves, or in conjunction with diseases of the viscera. (4) To a change in some gland whose secretion is necessary to the normal metabolism of the body, for example, to atrophy of the thyroid with its resultant hebetude as seen in myxœdema.

These conditions are all of great importance and have not been sufficiently studied, although they have been recognized for a long time. It was known years ago that a definite and large proportion of heart cases developed what is known as insanity, but it remained for Henry Head, in an article written in 1901, to draw attention to a train of symptoms often seen in diseases of the different viscera of the body, which he looked upon as distinct from the changes mentioned above. Although I do not exactly agree with him in that view, his article has been of such great value in directing attention to a train of symptoms different from those heretofore described, it would appear presumptive to criticize the work he has done.

Head draws a distinct line between the conditions noted above and what he has made out by most painstaking care in examining his cases along the line of an article of his written in 1896. In this first article he draws attention to the fact that in diseases of the viscera there are in certain cases areas of reflected pain corresponding to the segmental distribution of the nerves over the surface of the body in relation to the viscera involved. Clinical observation has shown that Head is correct in his ideas. After establishing this point he was led to investigate, as he puts it, what effect the stimuli of such pains would have upon the mental condition, and he has divided the results of his observations into the following parts: (1) Hallucinations of sight, of hearing, of taste and of smell. (2) Moods of depression and exaltation. (3) Suspicion. (4) Loss of attention and memory.

From the standpoint of the general medical man this is of great importance, and I am inclined to believe that it is also of great importance from the standpoint of the modern alienist. For example, if we look upon insanity as simply a deviation from a normal mental condition, that is, mental sickness, and if we take into consideration the finding of these symptoms as related by Dr. Head in his article, and as is drawn out in the cases I am about to report to you, it is easy to see how closely connected the two fields are. That is, the work of keen observers in the medical world along the line of the mental as well as the physical signs would lead us to suggest at once that there is merely a difference of degree in the cases which we report and those which fill our insane asylums. At the same time, a thorough examination by clinical men, in active practice in hospitals, would go far toward studying out the first signs of mental wrongness. Thus, the work that is reported to you to-night is not only important along the line that Dr. Head has shown in his article, but it suggests a field that promises to be of advantage to the human race. If we could get away from the names that are appended to different mental conditions and simply bear in mind that many cases of mental illness start with different conditions of physical disease, we shall have gone a long way toward solving the condition of mental wrongness, and if this paper brings the active medical man, the man in private practice and in the hospital, to work along that line and to report his results, a good deal will be accomplished. For, strange as it may seem, in spite of the importance of the original work by Dr. Head, scarcely any notice has been taken of it in this country, and there is not much connected with this subject to be found in English medical literature. The Germans, on the other hand, have paid much more attention to the question and their alienists are greatly impressed with its importance.

The simplest way to bring before you these different phenomena is to read the histories of cases selected from a series which it has been my fortune to meet with.

CASE 1. *Mitral stenosis. Hallucination of sight.*

A colored woman, 30 years of age, was in my care at the City Hospital in June, 1902. Her cardiac condition dated back to an attack of inflammatory rheumatism in 1899. She came into the hospital on account of pain in the left breast and over the epigastrium. This pain was superficial, constant and, at times, severe. On several occasions, on going through the ward, I noticed that she was much depressed and the nurse informed me that the woman frequently cried without known cause.

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[1] Read at the meeting of the Hospital Medical Society.

There were no signs of failing compensation and physically the woman was in fairly good condition. At first it was not possible to get any satisfactory information from her, but after a while the following history was obtained. Usually at dusk and early in the morning, and always after a severe paroxysm of pain, a figure would appear at the foot of her bed and peer at her. This figure was veiled, dark in color, and had two glaring black eyes which stared at her. She thought the figure was that of a woman, but could give no reason for that opinion. She was always frightened and felt her skin "creep," as she expressed it—the so-called goose-flesh. The figure would gaze at her for a time and then fade away. The woman thought that a spell had been cast upon her and that it meant some dire disaster. When the idea that an enemy had caused the figure was removed, as we succeeded in doing in time, the periods of depression and fear were banished.

Case 2. *Asthma and hallucination of smell.*

F. S., male, æt. 44, has been subject to attacks of bronchial asthma since boyhood. For four years his attacks have been infrequent, and for the past year he has had none at all. He has never suffered any pain. For years he noticed that for 24 hours before an attack came on he could not drink coffee on account of its smell, which was like sulphuretted hydrogen to him. This sign was so invariable that he came to look upon it as a warning that an attack was approaching. An examination of his nose showed nothing pathological.

Case 3. *Adherent pericardium. Hallucination of hearing. Alternating depression and exaltation.*

Ellen L., white, æt. 34, consulted me December 26, 1903. Ten years before she had had inflammatory rheumatism, from which she made a slow recovery, and she dated her cardiac trouble from that illness. Since then she has been subject to attacks of dyspnœa, weakness and pain over the precordium reflected back under the left shoulder-blade. With this reflected pain she has always had vertex headache. For three years past her attacks have been increasing in intensity, and for the last 12 months she has noticed at times swelling of the feet and cyanosis of the fingers. For four years past she has suffered from ringing in the ears. During the past twelve months, in addition to this tinnitus, she has waked up, always at night, with the hallucination of hearing the loud ringing of a bell. This ringing continues for about fifteen minutes after awakening. At first she thought the noise was real, but she came to the conclusion that this was not so, because there are no bells in her neighborhood, and she never hears them during the day. This phenomenon is generally manifested after a severe cardiac attack. For some time she has been subject to fits of depression, coming on without cause as far as she knows, and alternating with periods of physical exaltation. That is, after getting over the depression, she feels as if she could do a great deal of work, and frequently tries it, only to find that her strength is insufficient. This woman's hearing is unusually acute and there is no thickening or retraction of the ear drums.

Case 4. *Mitral stenosis, adherent pericardium, alternating depression and physical exaltation.*

A white woman, æt. 35, with a history of rheumatism ten years previously, came under my care in St. Joseph's Hospital in 1896. She was suffering from the usual symptoms of failing heart strength, shortness of breath, cough, œdema of the extremities and cyanosis. She complained of superficial pain through the left breast and back. She was treated by rest and venesection and for the time rapidly improved and, with periods of acute dilatation, remained in the hospital for eighteen months, when in one of her attacks she died. At the autopsy there were the usual signs of right-sided cardiac engorgement, mitral stenosis of an extreme grade, with adherent pericardium.

After attending her in the hospital for six months and seeing her daily, I found her once with her head covered, crying quietly. On being questioned about her trouble she could assign no cause for it. She was depressed and wretched, but did not know at what, and told me she had been suffering more pain than usual the day before. Such periods were frequent but never came when she was suffering from one of her attacks of dilatation. As a usual thing she was of a cheerful disposition and was much liked in the ward. At times she would try to do things which she was physically unable to accomplish. She told me that on some days she felt as if she could work as hard as she could when she was strong and well. Her final fatal attack was brought on after such an effort.

In this case were present the two moods, depression and physical exaltation.

Case 5. *White woman, æt. 30. Mitral stenosis, failing compensation, suspicion.*

This patient was also in St. Joseph's Hospital in the year 1898, and came into the house for practically the same reasons as Case 1. She too had an area of reflected pain on the left side of the chest, extending over the epigastrium to the liver. This pain was at times of great severity. She improved temporarily and was under observation for over a year. During her periods of greatest physical depression she was patience itself, but in her condition of physical betterment she was suspicious of everyone about her—the nurses neglected her, the doctors thought she was malingering, and, although these ideas would leave her for the time, thy would return afterward. This mood of suspicion was put down, unfortunately, as due to her disposition and dismissed as such. At the autopsy an extreme degree of mitral stenosis was found, with signs of venous engorgement. Both these cases occurred before there was any knowledge of such peculiarities, consequently they were not studied as closely as they should have been in regard to the hallucinations of sight, smell and hearing, and scalp tenderness.

The moods as shown in these two cases, depression and physical exaltation in one and suspicion in the other, are in my experience most common. Depression and suspicion, approaching at times to melancholia, are most marked in abdominal cases.

Case 6. *Asthma. Emphysema. Loss of attention and memory and unreasoning fear.*

Mrs. S., aged 50, a woman of high intelligence and education. She has been subject to attacks of bronchial asthma for 35 years, and as the result of these attacks she has a decided amount of emphysema. Up to three years ago she did not suffer any considerable amount of referred pain and tenderness, but from that time with her attacks of asthma she has had a good deal of pain referred to the upper portion of the chest in front and under the left shoulder-blade behind. Coincident with this, she has complained of the following symptoms: First, of unreasoning fear. This fear is not at anything, but is vague and she is unable to account for it. Second, loss of attention and memory, especially in reading. She finds it hard to fasten her attention on her book, and her memory of what she has read in the past is defective. Neither of these deficiencies is persistent and her memory is only defective as regards things in the recent past.

These six cases represent the hallucinations of sight, smell, and hearing, the moods of depression and exaltation and suspicion, the loss of attention and memory and unreasoning fear. In a brief way let us look into Head's explanation of these phenomena.

Hallucinations. The only necessary concomitant of an hallucination is headache of the reflected type. At the same time the pain stimulus must be of a certain bulk, and the more suddenly the pain appears the more probable is the occurrence of the hallucinations. Again, liability to hallucinations is increased by the presence of pain over the trunk of the body. Head thinks the character of the hallucinations may be determined by the position of the headache. Thus, in herpes zoster ophthalmicus with frontal headache, there were found visual hallucinations; with vertex and occipital pain, auditory hallucinations; and with temporal headache and visceral disease, hallucinations of smell and taste.

Depression.—Depression is an alternation of feeling tone in the direction of ill-being and is not an intellectual condition at all. It is characterized by its lack of projection, and is different from the depression to which the normal individual is at times subject in that diversion is useless. The characteristic of this form of depression, according to Head, is the lack of projection. Thus the individual is not depressed at anything, but is just vaguely unhappy. To produce this condition, the pain must be of considerable intensity, or last for a long time and at the same time involve a considerable area. Painful areas over the abdomen are much more liable to be accompanied by this depression than those in other parts of the body. In other words, the higher the area of pain, the less common the depression.

Exaltation.—This is not accompanied by any increase in physical strength. It is a vague feeling that one is able to do more than before. It is not a delusion of grandeur; the patient is never anyone but himself. He only feels strong and well again. There may be several reasons for this condition:

1. It may be a swinging to the other extreme after a feeling of depression and referred pain has passed off.

2. It may be a constitutional condition. Those who are subject to visceral diseases are often more susceptible to waves of ill and well being than the normal individual.

3. The feeling of exaltation may be due to ignorance of the gravity of the condition.

4. It may be due to an organic heart disease. Patients with aortic valve lesions are subject to periods of excitement of purely vascular origin.

Suspicion.—To produce this phenomenon there must be reflected visceral pain and at the same time depression and unreasoning fear. It is an easy step from a condition of depression or fear without projection to a feeling of self-contempt, and from that to the idea that people around are thinking ill of one. This condition is, as are the others, marked by its vagueness and lack of projection. Head holds that the distinguishing mark of this condition from that found in the insane is the ease with which the suspicion is removed.

Loss of Attention and Memory.—In cases of this nature it is not always necessary to have reflected pain, for this condition is often found without pain, but the loss of memory follows the loss of attention. The individual is taken up, without knowing it, with his visceral existence. Thus, for instance, when the patient reads, his attention is not wholly fixed upon the book, but only partly. So, as a consequence, there is afterwards no memory of what is read. In the normal state the human being is taken up with outside conditions, but in disease peculiar to the viscera outside impressions are rendered fainter and in their place the individual becomes conscious of his own ill being.

These then are the explanations of the phenomena according to Dr. Head. His facts on the whole cannot be disputed, but let us go a step farther and compare with these cases, which are according to his descriptions, a few others which seem to me a step farther in the same process.

Case 7. *Arterio-sclerosis. Loss of attention and memory. Confusional ideas.*

C. S., male, æt. 22, was referred to me by Doctor Paton. His family history was good except for the fact that his father died of tuberculosis. Five years ago he had typhoid fever, a moderately severe attack. He denies lues and has no scars or enlarged glands. For two years past he has not been able to fasten his attention on anything for more than a short space of time. He is depressed nearly always and is afraid he is going insane. His memory of past things is good, but the moment he attempts to do anything requiring concentration, his thoughts become confused. This man on examination showed a most remarkable condition of arterio-sclerosis for a person of his age. The apex of his heart was in the nipple line. His arteries were uniformly thickened and could be traced high up his arms. There was a marked accentuation of both cardiac sounds. His urine was negative. Blood pressure 200.

Case 8.—A white man, aged 58, another case of bronchial asthma of years' duration, who suffered pain about the chest in front and back. He noticed about a year ago that he commenced to suffer from dreams. He was always half awake and the dreams always dealt with the same subject. He was fighting with a gigantic snake, and his awaking was always a sense of great relief to him, but within the last two or three months he is no longer relieved on waking and is commencing to think that the snake is a real, tangible object and is lying under the bed concealed somewhere. If you talk with him and tell him how unreal this is, he agrees with you, but in a little while goes back to the fact that the snake is under the bed and is going to attack him.

Case 9.—A step further than this is the case of a motorman, æt. 35, suffering from aortic regurgitation, who at the first regarded his hallucination as mere incidents. The figures that he saw were generally indistinct and vague and were usually seen in the dusk of the evening or in the morning. Now the faces have taken distinct shape, are those of his relatives, many of them long since dead, and the man is beginning to believe that they tell him things about the future. This man will also listen and seem to be convinced, and then will come back to the point that he has the power of prophecy.

Case 10.—Also another case of mitral stenosis, a woman, æt. 36, who for years has been able to go about and do her work fairly well. She has been subject to dreams and at first thought they were nothing but dreams and they were pleasant. Of late they become extremely disagreeable and vivid. She has long conversations with dead people, and she also thinks she has the power of prophecy. She feels that these voices tell her to do things and she is getting ideas of persecution. She can be talked out of them for a while, but she returns to the point again and recites them as facts, and she has once attempted suicide. Both of these last two cases had signs of beginning failure in cardiac compensation.

The similarity between these two series of cases is suggestive. In the first class the individuals can be easily persuaded that their hallucinations are hallucinations, or that their moods have simply a physical basis. In the second class, however, such persuasion becomes impossible. One would think at first that this point of difference might be a vital one, but when we consider that an idea by continually being present can become fixed in the individual's mind, it is easy to see how the gradation can take place from one class of cases to the other. Finding such a train of symptoms is only a matter of asking for them, but as Dr. Head has brought out, and as I wish to emphasize again, in asking such questions a certain amount of tact must be used and the confidence of the patient secured. Apart from the interest attached to such histories, lies the fact that these individuals come first into the hands of the general medical man and not into those of the alienists.

As a summing up of the work that has been done, we may say:

1. That Head has shown there are various phenomena at times connected with disease which have not heretofore been described.

2. That by the study of causes of disease we may be put upon the road which may lead us to the proper solution of many causes of insanity.

3. That many symptoms have been grouped under the head hysteria which should not be so placed. As far as our knowledge goes there is a neurasthenic condition, which as we study more exactly we will find to be allied closely to the condition of the viscera.

4. That mental illness and physical illness are closely allied to each other.

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PROCEEDINGS OF SOCIETIES.

THE JOHNS HOPKINS HOSPITAL MEDICAL SOCIETY.

February 15, 1904.

The meeting was called to order by the President, Dr. Futcher.

A Simple Method of Obtaining Uterine Lochia for Bacteriological Examination. Dr. Little.

With the recognition of the bacterial origin of puerperal fever, and particularly of the fact that the prognosis in individual cases varies largely according to the character of the infecting agent, the taking of uterine cultures in all febrile cases has come to be a routine in hospital practise. The somewhat complicated technique necessary to obtain the uterine lochia without contamination, has undoubtedly interfered with its general employment, and is responsible for the resulting lack of appreciation of the necessity for surgical asepsis in ordinary obstetrics.

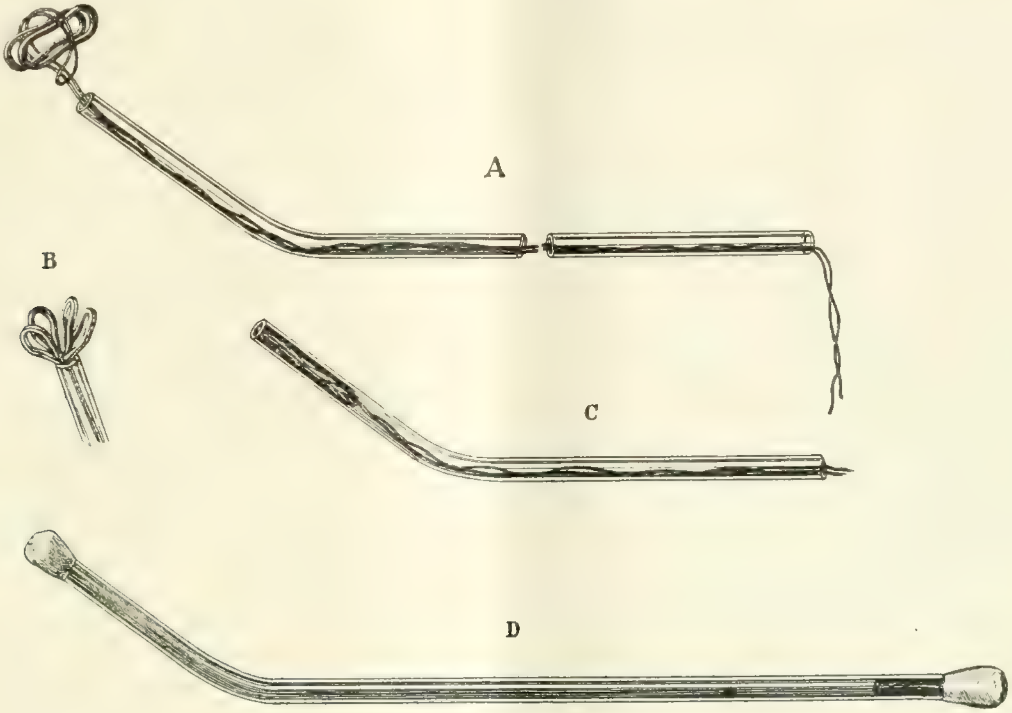
The procedure followed in the majority of obstetrical clinics, is that of Döderlein; i. e. the introduction into the uterine cavity of a curved glass tube, into which the lochia is aspirated by means of a syringe applied to its distal end. By this method a considerable amount of secretion can be secured, and an idea of its macroscopic character obtained. It, however, presents several disadvantages: first, the danger of contamination from the cervical secretion during its introduction; second, the difficulty of retaining the fluid in the tube when withdrawing it; and third, and most important of all, the invariable necessity for the use of an aspirator. Even when the latter can be sterilized, its attachment to the tube is often quite difficult, and an assistant is always required for its manipulation. Moreover, when the end of the tube infringes on the uterine wall, the plunger is sometimes drawn back violently by the negative pressure, and if the syringe has not been previously sterilized, bacteria can be aspirated from it into the tube if not into the cavity of the uterus. In other cases where too great a volume of air is exhausted from the barrel of the syringe and the end of the tube is freed, the lochia flows through the tube into the syringe itself. On the whole, the proceeding is very unsatisfactory.

To be perfectly satisfactory a method of obtaining cultures should overcome all these disadvantages, i. e. it should enable one to obtain a considerable quantity of the lochia with a minimum possibility of contamination from the cervix, should do away with the clumsy aspirator and finally should be capable of use without assistants, and without unnecessary disturbance of the patient.

The tube I wish to show you, combines all these advantages. As you will see from the drawings, it is a glass tube 20-25 cm. long and 0.5 cm. in diameter, with a lumen of 3-4 mm. It is curved slightly at one end to correspond to the shape of the uterus. Two small India rubber bands are tied in the middle with a stout silk thread, by means of which they are drawn well up into the tube, so that by traction on the thread they act as a plunger, each culture tube becoming in itself an aspirating syringe. Cervical secretion cannot enter the tube during its passage into the uterus, and the exhaust cannot be greater than the capacity of the tube. The instrument can be readily sterilized by boiling, and can be used without the necessity of an assistant, and the patient need be disturbed no more than for an ordinary vaginal examination. The pressure of the plunger in the distal end of the tube at the completion of the operation prevents the reflux of the obtained lochia, and the application of sealing wax to each end of the tube renders it fit for transportation to the laboratory without danger of contamination.

I have used this method in over a hundred instances and so far it has given great satisfaction.

fringes or loose tabs result. These may degenerate with the formation of lipomata. The fringes or villi at times interfere with joint motion and catch or lock the joint. The joint fluid in this class of cases may be normal or in excess if there be great irritation.



The Differential Diagnosis and Treatment of the so-called Rheumatoid Diseases (An Abstract). Dr. Joel E. Goldthwait.

The result of the study of a large number of cases of non-tubercular joint disease commonly spoken of as chronic rheumatism, rheumatoid arthritis, arthritis deformans, osteo-arthritis, gouty rheumatism, etc., seems to show that there are several distinct types of disease which can be differentiated both pathologically and clinically, and which require essentially different forms of treatment.

The characteristics of these forms of disease are so unlike that they apparently represent distinct diseases, and while it is not possible to entirely disprove any connection between them, for study, at least, they can best be considered as distinct conditions.

Of these types there are five which have been separated.

Chronic villous arthritis—uncomplicated.—The first type, variously spoken of as the dry, hyperæmic, or relaxed joint, really represents a villous arthritis, and while this villous type of synovial lesion may be present in any form of chronic joint disease, in this type it represents a purely local process and is not a manifestation of a general disease. The condition is seen usually in the knee, and is characterized by crepitus or creaking on motion with pain and tenderness on use. The structures of the joint are usually relaxed, the crepitation being due to the folds of the loose, flabby, and passively congested membrane rubbing together. At times under the continued irritation the folds become still further relaxed and

The treatment consists in the early stages in stimulating treatment locally with relief of any joint strain, and with bandages to steady the joint and limit the motion. If the villi or the lipomatous change is marked, these features should be removed by operation.

The process does not naturally tend to extend to other joints.

Atrophic, or *rheumatoid arthritis*, is a progressive disease, the ætiology of which is not known, characterized by swelling of the affected joint in the beginning, with a very early atrophy, which becomes more marked as the swelling subsides. At first, the atrophy shows in the cartilage, but gradually the bone and soft structures, even to the skin over the joint, undergo the same change. In the early stage there may be an increase of fluid in the joints with a distinct villous synovial process, both of which disappear as the atrophy develops. The disease is a slowly progressive one, the extension going on gradually for many years, and leads to marked crippling. In this type the blood shows but little departure from normal, and shows no special change as the disease develops.

The treatment is partly general, with rest, improved nutrition with forced feeding, tonics, oil,—either cod-liver or olive,—with a wholesome and generous diet in which meat is an important factor, whether red or white being immaterial. The eliminative functions should be kept free and large amounts of water should be taken, with some alkali, such as the phosphate of soda. At times the salicylates are of benefit, but if used it should be remembered that large doses depress, and therefore do harm, while small doses, such as five grains once or twice daily, will give relief if the drug is to exert any influence. Locally the treatment is stimulating, with encouragement of use, stimulating bathing, hot air, massage, and anything that tends to improve the nutrition and combat the essential feature, atrophy. If adhesions have formed, or if deformities have resulted, they should be overcome.

Hypertrophic or *osteo-arthritis,* may be a local or a general process, and is characterized by thickening of the edges of the articular cartilage forming ridges or nodes, which, becoming ossified, interfere with joint motion. As the process extends, the cartilage at the points of pressure is absorbed and the bone near the articulation becomes sclerosed. The essential feature in this type is hypertrophy, and the symptoms are due largely to the presence mechanically of the thickened bone either from the limitation of motion or by pressing upon or narrowing the space occupied by the nerves. The pain may be referred to any portion of the body, depending upon the location of the disease and the nerve pressed upon. The sciatic pain resulting from the nerve root pressure in disease of the lumbar spine is probably the most common of the referred pains. The cause of the disease is not known, but cold, exposure, strains, or injuries seem to be factors of importance.

The treatment consists of fixation or rest for the part affected, to prevent irritation, with only such internal treatment as would tend to improve the body tone, and regulate the eliminative functions. The disease is not usually a progressive one, and with proper treatment subsides, leaving little to show other than the thickened cartilage and new formed bone.

The blood shows no special changes.

Infectious arthritis includes most of the cases of acute, inflammatory, and chronic rheumatism as well as many of the septic processes, and the symptoms may be due to a toxine formed by any of the infectious organisms, or to the presence of the organism itself within the joint. The process may be non-articular or polyarticular, and many or a few of the joints may be affected, but, whether many or few, those which are affected become so, in the majority of cases, within a short time, with little if any further progression as is seen always in the atrophic type. The severity of the case depends upon the organism and the extent of the infection. If the organism itself is present within the joint, the capsule of the joint may be much thickened with resulting disability, as is true with the gonococcus, or there may be marked destruction of tissue with pus formation, if the pneumococcus, the typhoid bacillus, the streptococcus, etc., be present.

The blood is normal in the beginning, but gradually a secondary anæmia develops. The glands are enlarged throughout the body, but whether much or little depends upon the severity of the infection. In these cases the atrophy or hypertrophy seen in the two preceding types is not present.

For treatment, as the condition is practically a septicæmia, the general plan should be to combat this. Tonics, forced feeding, fresh air, with moderate quiet of the affected joint, and such treatment as would tend to lessen the local inflammation. In those cases in which the organisms themselves are present within the joint and show evidence of pus formation or marked capsular thickening, the joint should be opened and flushed out.

The prognosis in this type may be good or bad, depending upon the organism present, and it should always be remembered that the endocardium is not infrequently involved in such processes.

Chronic Gout.—The fifth type is less understood because so much less common, and with our limited knowledge, can probably best be described under the term of chronic gout. In the few cases studied, the essential characteristics are the same, the chief ones being deposits of the urate of soda in the soft structures about the joints with some bone absorption adjacent to the deposits. On first appearance these deposits may resemble or suggest the nodes seen in the hypertrophic form, but instead of being attached to the bone and being firm to pressure they are soft and can be moved about in the soft structures entirely without connection with the bone. Usually only a few of the articulations show such deposits.

Of the bone changes, the shaft of the bone frequently is affected, and in the fingers or toes an entire phalanx may be destroyed. The process involved only a small portion of the bone at a time, gradually extending into the rest of the shaft, so that when first seen the destroyed portion appears with a sharply defined, punched out edge.

The ætiology of these cases is not known, and comparatively little is known in regard to the treatment. It represents a type which apparently must be recognized, but about which much work must be performed before the cases can be treated intelligently.

The Pathological Lesions of the so-called Rheumatoid Diseases.

Dr. Charles F. Painter, of Boston.

In presenting this subject for your consideration I wish at the outset to state that the material forming the basis of this report has not been derived from post-mortem observation, neither has it come from cases so far advanced as to be subject to the criticism that they represent the "end results" of the rheumatoid process, but it has come from cases operated upon, oftentimes principally for the purpose of obtaining fresh tissue from the active stage of the disease and therefore represents acute processes, in so far as any disease may be regarded as acute whose lesions are actively being developed one after another over considerable periods of time. The changes taking place in a rheumatoid joint as a result of the activity of the specific cause of the disease, whatever that cause may be, are just as representative as those taking place in a tuberculous joint. We can usually identify the latter lesions when we see them some months or even years after the process is known to have had its beginnings. The lesions of tuberculosis, however, when the disease is inactive, are oftentimes extremely difficult to identify. They do sometimes essentially differ from the earlier manifestations and at times undergo changes which mask their distinctive character. This holds true in both diseases in the case of the microscopic and gross pathological appearances. Secondly, I believe that it will be generally accepted that in the two diseases where the pathologist is most frequently called upon to express an opinion as to diagnosis, viz.:—in tuberculosis and cancer, his opinion carries the greatest weight who possesses the most intimate knowledge of those diseases, not only from his understanding of the histological changes brought about in the tissues invaded, but from his familiarity with their method of onset and their clinical history. In passing judgment a conservative man does not rely upon any one group of signs or symptoms; when he does, he frequently has reason to regret his rashness. A great part of the confusion which has existed in the past about this group of diseases has been caused by the fact that the pathologist and the clinician have not worked in harmony; the observations of the one have not been checked by those of the other.

If these premises be accepted, and the material presented in this paper be regarded as representative of a typical period in the advancement of the disease in question I think we are in a position to proceed to the consideration of the subject.

Bearing in mind the clinical classification set forth by the previous speaker, I shall take up first Chronic Villous Arthritis; second, Chronic Atrophic Polyarthritis; third, Chronic Hypertrophic Polyarthritis, and fourth, but less exhaustively, because of the lack of material for its study, Chronic Infectious Polyarthritis. In studying these conditions they will be approached from five points of view,—(1) The histological changes in the periarticular structures of the joints; (2) in the osseous structures; (3) in the fluid aspirated from the joints; (4) from the study of the X-ray pathology, and (5) from the study of the blood and the metabolism of the organic and inorganic salts. As the X-ray has been perfected we are finding in it, in these diseases, as in tuberculosis, one of the best means of investigating the pathology of their lesions.

For the description of chronic villous arthritis the reader is referred to an article on this subject published in the *New York Medical News,* under dates of November 14, 21 and 28, 1903.

Chronic Atrophic Polyarthritis.—As has been stated, we have attempted to select a nomenclature which has some significance based upon the observed coincidence of tissue changes and clinical manifestations, trying to avoid the assumption of meaningless terms for different stages of the same disease.

Chronic atrophic arthritis we believe to be descriptive, in the first two adjectives at least, of an entity; the term arthritis, if it be not too literally construed to mean an inflammation of the joints, will serve our present purposes. That there are some features of the changes in the affected tissues resembling a true inflammation must be admitted, but that these changes can be identified with the specific action of any demonstrable organism, bacillus, or coccus, is certainly unsubstantiated, and we believe our present knowledge does not justify such an assumption.

This disease, though a constitutional one, shows its principal lesions in the joints. What the changes may be in the vital organs during its more active stage cannot be determined. Whether they would show tissue changes similar to those seen in the joints in this stage must be purely a matter of speculation. Necropsies upon patients dying late in the course of the disease have shown no distinctive alterations in the viscera or in the central nervous system. We must be content then, until opportunity offers, to study these tissue changes in the joints themselves, assuming that here is the active seat of the disease, since the clinical manifestations are principally local in the joints, and not constitutional.

Three structures are involved in every joint, viz.:—the capsule, both fibrous and synovial, the cartilages, and the bones. Grossly, the synovial portion of the capsule is invariably much thickened, and it is this thickening combined with the atrophy of neighboring muscle, which is the reflex atrophy seen invariably in joint disease, which causes the swelling of the affected parts. There is very little fluid in these joints as a rule, the swelling being due to the thickening of the synovial capsule and the conversion of this into more or less congested villi. At times one finds some fibrinous flakes within the joint, but this is usually when there is an increase in the amount of synovial fluid. The entire membrane is a good deal congested during the more active stage of the disease, and the hypertrophied villi within the joints are well distended with blood. Along the line which marks the shading off of cartilage into bone, one usually notes the congested character of the synovial membrane, raising it above the level of the neighboring tissue, like the pannus seen in tuberculosis. The cartilage is thinned throughout the entire extent of its surface, loses its glistening whiteness, becomes more or less granular and streaked, and in places shows eroded areas sometimes as large as the old-fashioned three cent piece, usually much smaller. Through these eroded spots one can sometimes see the cancellated bone beneath. The bone itself is also thinned; the intertrabecular spaces are filled with fat, and the usual cellular tissue occupying these spaces has been largely replaced by fat, apparently a degeneration similar to that occurring in the villi of the synovial fringes, giving rise there to the so-called arborescent lipomata. Several other degenerative or metaplasic changes have been noted besides the fatty metaplasia, e. g., to bone and cartilage and also a metaplasia to a tissue resembling lymph glands. The trabeculæ are less in number and smaller in size and do not seem to anastomose as they do in the normal bone. The vessels running in the bone marrow are many of them endarteritic, as they are observed to be in the case of the vessels in the enlarged synovial fringes. There are places in the specimens where there is some round celled infiltration, about the endarteritic vessels usually, but none of the other accompaniments of an active inflammation.

We cannot cut down and remove bone and cartilage as often as we would like in these cases and thus get material for histological study, but in the present perfection of the X-ray we have at our disposal a method of study which is adapted to giving us satisfactory and reliable evidence of what goes on in bone and joint structures in this disease. In relation to tuberculosis, Drs. Bradford, Brown, and Feiss have shown that the X-ray is capable of giving the most accurate information of the situation and extent as well as character of various bone lesions, and this in the early stages of the diseases, not merely after it had made considerable progress. Let us look for a moment at what it is capable of showing of the lesions of atrophic arthritis. The X-rays of the hands, knees, etc., which have been shown present, I think, as characteristic changes and changes of the same general type, as the microscope shows. They reveal the general shrinking of the cartilage from atrophy of this tissue; they show the diminution in density of the bones due to the lack of calcium salts, about which I shall have more to say a little later, and they show the thickening of the capsule and the general villous enlargement of the synovial membrane. In the later stages of the process in those cases where recovery from severe lesions is taking place, they also show some tendency to repair, with a suggestion of bony enlargement. But the cases where there is any liability to confound the atrophic with the hypertrophic processes are extremely rare, and we must remember that atrophy does not go on with absolute symmetry in these joints any more than hypertrophy goes on with absolute symmetry in the joints of chronic hypertrophic arthritis.

In regard to the bacteriology of the fluids obtained by aseptic aspiration our results have been negative. The technique described by Bannatyne has been scrupulously followed in ten cases and no organisms obtained. That organisms may be found in cases whose joints present clinical appearances similar to those of the chronic atrophic arthritis is not doubted, but I believe those cases really belong to the infective group that are to be spoken of later.

Regarding the changes in the blood in these cases it has seemed to me that in comparing the results of the blood examination made by Dr. Erving upon cases of chronic atrophic arthritis with that of the blood in the acute arthritis of rheumatism and other types of infective arthritis, we have a suggestion speaking against the supposed infectious character of the type which we are considering. In acute rheumatisms and other infectious processes where I have seen the records of blood examinations there is a low hæmoglobin content, a leucocytosis, and a slight diminution in the number of reds. In acute rheumatoids or chronic atrophic arthritis the hæmoglobin was high, there was no increase in leucocytes, and in both men and women the red count was appreciably above the normal for the respective sexes. How much weight should be given to this sort of comparative observation is perhaps questionable, but it seems to me legitimate to say that it speaks against any similarity in pathology in these two types of arthritis.

During the past three years we have been carrying on a chemical investigation upon the metabolism of the inorganic salts in this disease. The nitrogenous metabolism has been studied at the same time. This investigation was instituted because of the clinical suggestions that were being forced more and more upon us that the fundamental cause of this disease was not to be ascertained through the channels of pathological research. The results of the series of observations upon atrophic arthritis showed a reversal of the ratio of calcium to magnesium as compared with the normal cases. It also showed that twice as much calcium was eliminated in the urine and feces as was ingested, and inasmuch as the clinical and pathological study of the cases tended to show an atrophy and softening of the bony trabeculæ, and as we know the larger part of the calcium salts of the body are in the bones, our metabolism study seemed to show that the bones are being impoverished through some disturbance in their metabolism. (The full report of this work is to come out shortly in *American Medicine.*)

Two observations were made upon the same patient, the first at a time when the joints were acute, and two years later when they were all quiet, and in this case the amount of calcium excreted at the second observation was equal to her ingesta and the ratio of calcium to magnesium had been restored to normal.

Hypertrophic Arthritis.—The material studied in our investigation of this disease has been obtained chiefly from excisions of the hip in cases of morbus coxae senilis. On gross examination, when the joints affected with this process are opened, one is struck with the relative absence of the infiltration of the capsule seen so constantly in the atrophic arthritis. There is much less of the villous hypertrophy; there is usually not much fluid present unless there has been recent joint strain; the synovia is not much congested; the point where the cartilage shades off into synovial membrane is apt to be congested and one usually notes some elevation of the tissue along this line into a ridge at the points where later one finds osteophytes developing. This is generally noted most conspicuously in the lateral aspects of the femoral condyles in the knee, or if in the hip just at the epiphyseal line and along the superior lip of the acetabulum; if in the phalangeal articulations sometimes in the lateral ligaments themselves. The cartilage has a denser, more ivory-like appearance, and is materially thickened, not only as compared with that in the atrophic type, but as compared with the normal. It has not lost its glistening bright appearance, and does not usually present erosions like those of atrophic arthritis or tuberculous arthritis, or of infective arthritis. In the cases where erosions occur in hypertrophic arthritis, they occur when the function of the joint has been impaired by the overlapping of the hypertrophied bone and cartilage, and are in the nature of decubitus erosions or else represent the dimples left in the cartilage where osteophytes have been chipped off. It is in this type of arthritis that one finds detached pieces of cartilage free in the joint. In places large sized and isolated spurs of hypertrophied cartilage project directly into the joint and when villous hypertrophy is noted in these cases to any considerable degree it is in the neighborhood of these spurs, as though the traumatism of the spurs caused the synovial membrane to become locally thickened.

It is extremely difficult to prepare this osseous and cartilagenous tissue for histological examination on account of the difficulty of decalcification. The wet specimen (here shown) had been in 20 per cent. HNO_3 for several weeks and frequently changed before it could be cut at all. The bone trabeculae seem very large if you compare them with the trabeculae of the atrophic type; they anastomose normally; take up the stains naturally, and show the usual amount and customary type of intertrabecular cellular tissue, except in those specimens where prolonged decalcification has been necessary, in which case the HNO_3 has eaten out the cellular tissue. There is no undue amount of fat tissue and the vessel walls do not manifest the endarteritic changes seen in the atrophic bone, though the increase in the number of vessels is marked. I have never observed, as some writers claim they have, both the atrophic and the hypertrophic lesions in the same joint, where I have had the opportunity to study the inside of the joint during life, and where the *clinical* symptom-complex revealed the two types unmixed.

The study of these lesions by the X-ray is entirely confirmatory of the observations just made upon them grossly and histologically. The passage of the rays through this sort of bone is much more impeded than in atrophic arthritis and the osseous tissue is much more dense throughout. The cartilage being hypertrophied rather than atrophied, shows a broader line than is seen in the atrophic type between the osseous components of the affected joints. A conspicuous feature of the hypertrophic arthritic lesions as shown by the X-ray, as in life, are the irregular spur-like formations of osteophytes projecting not so much into the joints as overlapping the joints and causing the impairment of function so commonly seen in this type of arthritis. As a result of this restriction in motion and consequent impairment of function, abnormal pressure is brought to bear upon restricted portions of the joints, and it is in these that the cartilage becomes worn away and erosions appear which have caused some observers to maintain that the essential lesions of the atrophic arthritis are found in the hypertrophic form. On the other hand, one sees occasionally a certain amount of hypertrophy in the otherwise markedly atrophic joints, but this is due to the repair process which takes place in atrophic arthritis, and must be distinguished from that of hypertrophic arthritis.

The Blood Examination.—In a study of any disease where there is, even remotely, a suggestion of a bacterial origin, it would be a serious omission to overlook the blood examination. In the study of the pathology of these diseases, we have looked into this matter particularly in the cases of the hypertrophic and atrophic types.

I will summarize the results obtained by Dr. W. G. Erving, who made careful observations in our clinic upon twenty cases of atrophic and twenty cases of hypertrophic arthritis, being careful to select patients where there were one or more joints in the active stage of the disease, so far as clinical symptoms would permit one to judge.

Dr. Erving studied the blood in forty cases which he groups as rheumatoid arthritis and osteo-arthritis and gives a summary of the blood conditions as regards the red blood cells, the hæmoglobin, the leucocytes, and the differential count of the last. In both groups the count of the red blood cells ranged slightly higher than normal and the hæmoglobin percentage was close to the 100 mark (the Tallquist scale was used). This was true also of the pale, sallow, poorly-nourished sufferers from a more or less general rheumatoid arthritis. There was present in most of the cases a slight leucocytosis, but this seemed to bear no relation to the severity of the symptoms or to the duration of the disease, and the differential count was almost normal, some cases showing a relative decrease of the polymorphonuclear cells and a relative increase in the mononuclear elements.

In short, the condition of the blood is not such as would be expected in diseases of such a general wasting nature. No abnormal elements such as microcytes, macrocytes, nucleated reds, or other signs of hæmic degeneration were found.

The same series of observations have been made since the appearance of this paper on twenty more cases with similar results. There are high leucocyte counts and secondary anæmia in certain of the polyarticular arthritic cases, but they belong to the infectious class.

Infectious Arthritis.—This type undoubtedly represents the largest group of the three here under discussion. The lesions so far as they can be studied are alike in their main characteristics, and I believe will be shown to resemble each other as closely as their clinical symptoms will when they are more thoroughly understood. I have had very little opportunity to study this type of arthritis histologically. The few cases I have seen have been apparently gonococcal infections. In these joints there is much more likely to be a considerable excess of more or less turbid synovial fluid when they are opened during the acute stage; the synovial and fibrous capsule is considerably and *uniformly* thickened, sometimes markedly thickened. There does not commonly result as much villous or arborescent hypertrophy as in atrophic arthritis, but the general thickening of the capsule and the adhesion of the synovial to the fibrous capsule is very marked, in this respect differing from the two previous types. This infiltration is with dense masses of round cells, and many more leucocytes than are seen in atrophic or hypertrophic arthritis. The cartilage is not generally thinned, but is at times eroded; there is no osteophytic enlargement; there are frequently great numbers of firm adhesions between the layers of the synovial membrane so that a good part of the synovial pouch becomes obliterated by these adhesions, which later becomes extremely firm and fibrous, resulting in a practical ankylosis. In this, as in the case of hypertrophic arthritis, the erosions only occur after a practical ankylosis from adhesions or from actual necrosis.

An X-ray in these cases shows an absence of any cartilaginous or osseous change. There are few erosions and no osteophytic formations. The capsule, when the negative is properly developed, will show decidedly the thickening of this structure. The presence of the infiltration of the capsule and the effusions accompanying these lesions obscure the X-ray picture very much and cause a peculiar blurred appearance in these cases, which is more or less characteristic. The blood count, certainly in the majority of cases, will show a greater or lesser leucocytosis, a lowered percentage of hæmoglobin, and a greater or lesser degree of anæmia, thus pretty clearly separating this group of arthritis from those studied by Erving, and heretofore referred to.

To this group belong the arthritides secondary to the acute infectious diseases and tonsillitis; those due to the pneumococcus and gonococcus; Still's disease, pyæmia, and septicæmia; and probably the so-called acute articular rheumatism. The blood in all these conditions uniformly shows a different picture from that in atrophic or hypertrophic arthritis. No metabolism work has as yet been carried out upon patients suffering from this type, unless, perchance, one case in our series represented such a condition.

Discussion.

Dr. McCrae.—We are very much indebted to Drs. Goldthwait and Painter for the very interesting talk they have given us. The whole question of arthritis is in such a mixed condition that one hesitates very much before discussing it. We have grouped together a number of conditions which perhaps have one common feature, namely, arthritis.

I think in this clinic we recognize several definite groups of arthritis cases. First are those associated with a definite organism, such as the arthritis associated with a gonococcus or with a pneumococcus. Then there is the large group of cases which we term acute articular rheumatism, and it seems likely that before long we may be able to recognize these cases definitely, or in other words, that some distinct organism will be found as the cause. Then comes a group of cases which we put under the general heading of arthritis deformans. One of the first points to decide is whether under this heading we may not have two distinct diseases. As has been shown to-night, there are two distinct conditions shown anatomically, namely, atrophic and hypertrophic. As I understand Dr. Goldthwait, he is rather inclined to separate these. The opinion in this clinic at present is rather to consider the two conditions as varying manifestations of the same disease. Upon the question of the etiology of this large group we are very much at sea. I think here we have been impressed with the infective nature of many of the cases. Dr. Goldthwait has referred to the condition known as "Still's disease." That we regard as merely the form of arthritis deformans occurring in early childhood. I think we have seen all grades of like cases from childhood up to adult life. The glandular and splenic enlargement become less marked in the older patients. The whole picture in those patients suggests an infection. As to whether this is due to a specific organism or to the toxines of various organisms, I do not think we can say.

In conclusion, if I may be allowed to say before their faces what I have often said in their absence, I feel that we owe them a great deal for the stimulus they have given to the proper study of this class of disease.

Dr. Finney.—While Dr. Goldthwait was speaking I could, from his description, recognize some of these joint affections as conditions that I had met with in my own experience and I can recall now a number of illustrations representing just the features he has described, and I may add that in the treatment of these cases I have many times been at a loss to know just what to do.

In several of them we attempted, as Dr. Goldthwait has suggested, to excise the villi and remove the lipomatous growth, but always in a half-hearted sort of way and never with anything like the thoroughness he has suggested. I shall now feel encouraged to attack these cases with more assurance and with the expectation of more satisfactory results than I have secured in the past.

I would like to ask Dr. Goldthwait what were the functional results in the cases where such extensive excision of the villous growths has been practiced, as in the case of the first specimen passed around. I think that much of the ultimate success must rest upon the painstaking care that one exercises in the after-management of these cases, as regards massage, active and passive motion, etc. It requires much patience to follow these patients for months and years, but any one who knows Dr. Goldthwait can appreciate the amount of care and attention he must have given to this work.

I had thought heretofore that these two forms that Dr. Goldthwait has described, the atrophic and the hypertrophic, were but different manifestations of the same pathological condition. It would seem, however, that Dr. Goldthwait and Dr. Painter have made out a very strong case in favor of the idea that they represent different pathological conditions.

Dr. Bloodgood.—I wish to add my thanks for these admirable papers. It is a credit to orthopedic surgery to enter this new field and to investigate a series of chronic joint lesions which the medical clinician has acknowledged his inability to aid, and in which as yet the general surgeon has shown but little interest. Contributions of this character have an excellent influence, because they aid in the earlier recognition of similar lesions. In this earlier period the possibilities of accomplishing more satisfactory results are greatly increased.

My own experience with joint lesions brings out the fact that the clinical picture and the pathological changes vary to such an extent at different stages of the disease that they are very likely to be considered, both clinically and pathologically, as different kinds of arthritis.

The most important fact in the treatment of both acute and chronic joint lesions is that treatment should be instituted at a period in the disease in which the pathological lesion has not extended beyond the possibility of a return to normal. The ultimate tendency in all forms of arthritis is to the destruction and replacement by fibrous tissue of the essential tissues of the joint, the synovial membrane and the articular cartilage. When this destruction has been accomplished there is no hope to restore the function of the joint. The possibilities of early recognition and cure are greatest in infectious arthritis and tuberculosis. In infectious arthritis it is most important to aspirate the joint effusion at once. The demonstration by cover-slips or culture of the presence of bacteria is a positive indication—or better, a command—to open and to wash out the joint cavity at once. This treatment has been followed in Dr. Halsted's clinic for years. In cases admitted to the clinic in the early days before the acute inflammation of the synovial membrane has reached an irreparable stage, the results of arthrotomy and irrigation have uniformly been most satisfactory, and joint function has been perfectly restored. I have discussed this treatment and the results in detail in the December, 1903, number of *Progressive Medicine*.

Dr. Goldthwait.—It has been claimed by some observers that the atrophic form of this disease is the acute stage, and the hypertrophic, the chronic stage of the same disease, but this does not seem to be borne out by facts.

Genito-urinary surgeons tell me that the majority of gonorrheal cases are of a slight character and get well in a few days, and with these there is only a slight joint effusion, representing probably a toxæmia. It is only in a few cases that there is the more active process which goes on to infiltration of the capsule, due to the presence of the organism in the joint with a long tedious illness, leading usually to serious impairment of joint function. In the treatment of such cases we should not open any joint until there is a distinct reason for it, but if after two or three weeks the process is still active, it is well to open the joint and flush it out. If the diagnosis is not clear in any case, after waiting a reasonable time and resorting to all the means of diagnosis we have, tuberculin, X-rays, etc., I feel that in many cases it is wise to open the joint for diagnostic purposes.

I agree with Dr. McCrae that although we do not know the organism associated with many of the cases of acute articular rheumatism, the picture is so clearly that of an infection that it is perfectly proper to call them infectious arthritis. The essential characteristics are the same and whether you have pus formation or not depends upon the nature of the micro-organism present in any particular case.

March 7, 1904.

The meeting was called to order by the President, Dr. Futcher.

Exhibition of Medical Cases. Dr. McCrae.

The patient I wish to show the Society to-night is interesting, especially in view of the recent communication presented here by Drs. Goldthwait and Painter, of Boston. You will remember that, in speaking of the rheumatoid diseases, they used the term "infective arthritis," and included under this term a number of cases which we have usually called arthritis deformans.

This patient illustrates one of the most interesting divisions of arthritis deformans. There are many debatable points in regard to the etiology and to the grouping of cases of that disease. One must remember that in this disease we have previously too often considered only the late manifestations. We have wrongly regarded it as a disease of advanced life, with marked degenerative changes, forgetting that in its earlier stages it is more or less of an inflammatory nature.

The patient is a male, aged 20 years, who complains of joint trouble. He has always been strong and healthy. There is no history nor any evidence of gonorrhea. His illness began about three months ago in the left shoulder. There was severe pain, swelling and tenderness. Soon both knees and one ankle were involved. The small joints have escaped completely. He has had some fever, although this has never been high. The condition is one of acute polyarthritis.

Examination shows an unusually healthy-looking young man. The joints now troubling him are the right shoulder, the right knee and one ankle. There is a certain amount of swelling of these, some restriction of motion, more or less boggy resistance and definite creaking. There is a general glandular enlargement and an enlarged spleen. His reflexes are increased. The blood count is normal, there is no leucocytosis, the urine is clear and his temperature normal.

Such a condition speaks for an infective process or the results of such a process. The case is of special interest, I think, when considered in association with that group of cases which has previously been termed Still's disease. Dr. Still described his cases as occurring in children, but here we have practically the same condition, only less marked, both as to the splenic and glandular enlargements. The opinion has been gaining ground that Still's disease is not a definite entity but is merely an arthritis deformans occurring in childhood. I think it is a reasonable view to take that these cases are all manifestations of the same disease.

The future course of these cases is variable. A certain number recover very well. This patient may in a few months be, to all intents and purposes, a well man, but he may have recurring attacks or there may be more or less marked changes left in his joints. If we regard these cases as an infection of some kind, an interesting point arises as to its nature. Concerning this there are two views, one that it is a specific infection with a definite organism and another that it probably follows infection by any one of a number of different organisms such as those of gonorrhea, influenza, mumps or measles. That is a matter yet to be cleared up, but we do know this, that any subsequent infection will alter the conditions very markedly. If this patient recovers fairly well and six months later contracts influenza or some other infection, he will probably have a recurring attack of this general trouble.

The question of treatment means first getting the patient into good condition. As to the joints, I am personally rather inclined to advise the opening of the most affected ones. The

X-ray plates in this case show that as yet there is no erosion of the joint surfaces. That supports the advisability of operating, for we know that if left alone the joint surfaces suffer sooner or later, and we have the impaired motion of the later stages.

Exhibition of Medical Cases. DR. COLE.

Dr. Osler has asked me to present this case of probable tuberculosis of the parotid gland to the Society to-night. It is interesting, first, from the standpoint of diagnosis; second, if it be tuberculosis of the parotid, on account of the rarity of this condition; and thirdly, in connection with the question of the mode of infection in parotitis.

The history briefly is as follows: The patient, a colored man, aged 34, was admitted complaining of "swelling in front of the ears." There is no history of tuberculosis in the family and the past history of the patient is unimportant, except in two particulars. First, there is a history of lues, the primary sore occurring about eight years ago, and second, the patient was admitted to this hospital five years ago with tuberculous glands of the neck, which were removed. Since that time he has been quite well and has been regularly at work up to about nine weeks ago, when he was suddenly seized with a sharp pain in the left side of the chest. He had to stop work and for six weeks was confined to bed most of the time. The history the patient gives of this attack makes it probable that he was suffering from a pleurisy and probably not an acute lobar pneumonia. For the past three weeks there has been no cough or fever. About 10 days after the onset of the illness noted, the patient accidentally noticed an elevation in front of each ear which rapidly grew to the present size. These tumors have never caused him any pain or inconvenience and he is only conscious of their presence when he feels them or observes them in the mirror. There has been no pain over the cheeks, no increased flow of saliva.

You now see a moderately healthy looking man with a large scar on each side of the neck; these are remains of the old operation wound. Just in front of the left ear is a swelling about the size of a walnut which occupies the parotid region and on palpation is found to be rather soft and fluctuant. In a similar position on the right side is a smaller elevation, about the size of a hickory nut, which is quite firm and hard. Yesterday a needle was inserted into the fluctuating tumor on the left side and about 2 cc. of a dirty yellow fluid withdrawn. This was found to contain mainly necrotic caseous material with a few leucocytes. A very careful search for tubercle bacilli has been made, but none have been found. Cultures made from this fluid are negative. A portion has been injected into a guinea-pig, and we shall later know the results of this test.

As to the diagnosis, it is pretty evident that an acute infection and new growth may be excluded. With his history, the possibility of syphilis must be considered, but the early breaking down of the tumor on the left side renders this improbable. In view of the fact that he has had tuberculous lymphatic glands in his neck, that he has just been suffering from a pleurisy, the remains of which give rise at present to signs of thickened pleura, it is more than probable that the condition is one of tuberculosis. The patient will be transferred to the surgical side for excision of these masses, and the histological examination of them, with the results of our guinea-pig experiment, will make the diagnosis certain.

Tuberculosis of the parotid gland is an exceedingly rare condition and a very few cases have been reported. The condition has been quite fully considered in an inaugural dissertation for last year by Ludwig Borchardt, of Freiburg. He was able to collect only 10 cases in the literature besides the one case reported by himself. I have also found a further case mentioned by Köenig in his text-book on surgery.

One of the most interesting questions in connection with this subject is in regard to the cause of the relative immunity of the salivary glands to this infection, to which man and most of his organs are so susceptible. Of course a full discussion of this point would involve a consideration of one of the most interesting and fundamental questions in the pathology of infections, that of the relative susceptibility and immunity of organs to given infections. It may be mentioned, however, that Borchardt quotes some interesting experimental work of Paoli with reference to a possible antagonism of the saliva to the growth of the tubercle bacilli. He was unable to demonstrate any such antagonistic action, however, either of the unchanged saliva or that freed from the mouth bacteria by heat.

A further question is as to whether in these case of tuberculosis of the parotid the condition is a true infection of the parotid tissue or of the lymphatic tissue lying within the parotid substance. According to Poirer, Cuneo and Delamere (The Lymphatics, translation by Leaf, 1904), lymphatic glands in considerable numbers are scattered throughout the parotid space. These are of variable size, from those easily recognized by the eye to those microscopical in size, "besides lymphoid masses of variable shapes and sizes which surround the acini." The histological study of the specimen in Borchardt's case seemed to show that the condition was one of "tuberculosis arising in the lymphatic apparatus of the parotid which led to secondary atrophy of the parenchyma of the gland, which did not appear to share actively in the inflammatory process." Some of the other cases also appear to have been analagous, though others were apparently true infections of the parotid tissue.

We will probably find that in our case the infection is a lymphatic one, as the previous history makes it probable that the process is simply an extension upward of infection of the lymphatic glands of the neck.

So long as there is so much doubt as to the mode of infection in the acute parotitidin we cannot hope for a clear knowledge in regard to this with these very rare chronic forms. Virchow's view as to the infection arising from the mouth through Steno's duct is probably true in a large proportion of the cases, though in some of the acute diseases at least the infection must be a hæmatogenous one. Otherwise how can we explain the comparative frequency of parotitis in typhoid and its rarity in pneumonia when in the latter disease the mouth must contain enormous numbers of the virulent organisms? The whole question is an exceedingly interesting one and well worth further experimental study.

An Experimental Study of the Eosinophile Leucocytes during infection with an Animal Parasite (Trichina spiralis). Dr. Opie.

(See Bulletin for March, 1904, page 71.)

The Origin (chemical) of Leucocytes in Leukemia. Dr. Emil Schmoll.

(See page 238).

Myomectomy in its Relation to Pregnancy. Dr. Kelly.

Dr. Kelly stated that formerly in all cases of myoma panhysterectomy or supravaginal hystero-myomectomy was done, but with improvement in technique myomectomy has been more commonly practiced. Two hundred and thirty-one such operations have been done at the Johns Hopkins Hospital, with six deaths. The following are the reasons for the procedure: It removes the disease without the uterus; it avoids menstrual disturbance and an artificial menopause; it allows conception; it does not cause the mental distress which accompanies removel of the uterus. Of 140 subjects reviewed by Dr. Kelly from his own work, four have conceived. The patients presented various types and sizes of myoma. Two of them have borne full-term children, one miscarried, and one is now pregnant. Schauta, Wurder and Olshausen have reported cases of conception following myomectomy, but there is no series which shows quite this number of successes.

Discussion.

Dr. Noble.—I had no idea of talking about myomectomy when I came over here this evening. The subject is one, however, in which in common with most gynecologists I have been interested, though not in exactly the same way that Dr. Kelly has. I began doing myomectomy early and believe it to be a very valuable operation; but I was never enthusiastic about extending the indications for the operation and so the number I have done has been relatively small. We had a discussion on fibroid tumors in Philadelphia within the past month and consequently I remember my own statistics. I have done 36 vaginal myomectomies and about 35 by the abdominal route. The indications that I have always laid down are, first, that the woman should not be too old. It always seemed useless to attempt it with a woman who was probably too old to bear children, for it is a more dangerous operation than hysterectomy. I have had no deaths in the abdominal cases, but in the vaginal myomectomies quite a number of the tumors were sloughing and there was sepsis present at the time of operation. Two or three patients died. If the woman is over 35, the indications would have to be very strong from the woman's standpoint for me to decide on this operation. Again, if there were many tumors I would not feel that it was a wise operation, and therefore I think four is the largest number I have ever removed from one uterus. Another reason that influences me is that if there are many fibroids of an appreciable size the chances are that there are others which are not appreciable and these may be left.

For those reasons, and being a conservative man, although some people say I am not conservative, I have not extended the indications for the operation. I have not worked up the question of pregnancy following these operations, but I recall the fact that two of the women I have operated upon have since borne children. From that standpoint, the way I feel about the matter is that if the woman is not above 35, has had no children and is desirous of having a child, and there are not many fibroids present, and she and the husband, knowing the greater risks of the operation, are willing to take the risk, I should operate. But if those indications are not met, I prefer to do hysterectomy.

Observations on the Study of the Sub-Clavian Artery in Man. Dr. Bean. (See Bulletin for June, 1904, page 203.)

April 18, 1904.

The meeting was called to order by the President, Dr. Futcher.

On the Surgical Importance of the Visceral Crises in the Erythema Group. Dr. Osler.

For the benefit of the students I will say a few words on the classification of colic, and I will refer you to a good paper by Dr. Musser on the subject which appeared a few weeks ago in *American Medicine.*

In the first place, there is an interesting group of cases of colic associated with the intoxications, as, for example, in lead poisoning, much less frequently uræmia, and less frequently still with morphia. It is not usually recognized that in these latter intoxications there may be recurring attacks of colic. In morphia habitues when the morphia is being gradually withdrawn colic may be of a most severe character.

Secondly, a large class of cases of abdominal pain associated with functional and organic disturbances of the nervous system; hysteria is sometimes associated with pain simulating peritonitis or appendicitis. An interesting series of such cases was reported by Dr. Bristow. Perhaps the most typical form in this group is the well-known crises seen in tabes.

Thirdly, the abdominal pain associated with disease of the lung or pleura. The initial abdominal pain in these diseases may simulate appendicitis.

Fourthly, a group associated with certain cardiac conditions. In pericarditis the pain may be referred entirely to the epigastrium. In angina pectoris, the recurrent attacks of pain may be altogether below the ensiform cartilage.

Fifthly, there is a very large group in which the pain is due to lesion of one of the abdominal organs, the peritoneum, the stomach and the intestines of course heading the list; the liver, the kidneys, the pancreas not so frequently; the spleen least frequently of all.

Lastly, you have the abdominal pain associated with pelvic disease, a common form and very difficult to recognize.

This is a convenient classification of the conditions in which we meet with severe abdominal pain. I wish to call your attention to-night to a very striking class of cases in which the abdominal pain is a feature of such dominance that the patients may be admitted to the surgical wards and a laparotomy performed for a functional colic due to angio-neurotic œdema or puncture of the intestinal wall.

Case 1.—A young girl, aged 17, a patient of Dr. Fox's, seen by Dr. McCrae on the first of December last. I will read his note (reading). She was found in bed in a curious attitude seemingly in severe pain of an unusual character. Examination of the abdomen was negative; she was not tender and the hand could be passed deeply in all directions. The knee joints were tender and red. She had received large doses of morphia, which only allayed the pain for a short time. The diagnosis of abdominal pain with arthritis was made and she was brought into the hospital. Many of you remember that she was a healthy-looking girl with a marked arthritis. There was a slight amount of albumen in the urine and numerous tube casts. On examining the abdomen we noted the mark of an incision in the upper right quadrant. She had been healthy as a child and her present illness had begun six months previously with recurring attacks of pain in the epigastrium and in the left side. These came on every week or two and lasted for several days. The pain had no relation to the food taken and was not relieved by any special position. In August the pains recurred with such severity that the diagnosis of intra-abdominal trouble was made and she was taken to the City Hospital and an operation performed, but nothing of any importance was found. The condition was thought to be gall-stones.

After a brief visit here in the hospital she went home feeling fairly well, but returned in a short time with a history of recurring pain and for the first time then had bleeding from the nose. At this time we found an erythematous eruption on the left flank. This case belongs to a remarkable group in which, with a skin affection, purpura, angio-neurotic œdema or erythema there are attacks of colic.

One of my first cases was a boy with the most severe attacks of pain, during which he would almost go into convulsions. I had watched him for some time, but on one occasion when he had these attacks another physician was sent for who knew nothing about his history and who made, very naturally, the diagnosis of renal colic. The mother was requested to take him to a surgeon, but fortunately she came to see me first, and, as subsequent results showed, there was no occasion for an operation. This boy had skin lesions of three different types: first, a distinct erythema, then marked angio-neurotic œdema, and finally purpura.

A second case, No. 20 on the list which I have published, was a boy, aged 7, admitted to the surgical side first for appendicitis. There he was found to have purpuric spots on the body and was transferred to the medical side. He had had these attacks of skin lesion associated with colic for several years. To a third case Dr. Hamburger might refer if he were here. A young woman who had many attacks of nausea with vomiting, with tenderness over the abdomen; an operation was performed for appendicitis but the appendix was found to be normal. Following the operation angio-neurotic œdema appeared on the face and she has had several similar attacks since.

In the first number of the new *Journal on Children's Diseases,* published in England, there are three cases in which operation has been performed and in which hemorrhagic infiltration and œdema were found.

Briefly, the cases may be grouped into, first, those in which the colic occurs in connection with a pure angio-neurotic œdema—Quincke's disease. They are not uncommon, as angio-neurotic œdema is not a rare disease and it may occur in several members of a family. I understand that the case of Dr. Hamburger's to which I referred belongs to a New Jersey family whose history I have reported and in which the disease was present in six generations. The original case in the family was under the care of Benjamin Rush, and in two instances death resulted from œdema of the glottis.

Secondly, there are cases in which the skin lesion is simply an urticaria, and as that is such a common affair it is possible that many of these cases in which the pain associated with it is supposed to be colic from indigestion may be really a part of the nervous affection. In a third class there is arthritis associated with the erythema or purpura and colic, the group which Henoch described and the form known by his name.

Fourthly, there are the cases in which the lesions are those of erythema multiform with or without œdema and most frequently with more or less redness and purpura. Interestingly enough, as in several of my cases, these different lesions have been present in the same patient in different attacks. In the first case I reported the boy had angio-neurotic œdema in one attack, ordinary erythema in another, and purpura in another attack, showing that the skin lesion is a variable affair in the disease.

Finally, there is the remarkable group of cases, really the most difficult to recognize, in which there is only recurring colic and nothing else. If you look over the list of 29 cases I have reported you will see that in a number of those cases colic recurred for years and years before any skin lesion appeared.

The condition is one of very great interest and I bring it before you because of its surgical relations, and it certainly has to be thought of seriously before performing a laparotomy for a doubtful abdominal colic.

Discussion.

Dr. A. D. Atkinson.—Within the past three months I have seen two cases which probably belong to this class that Dr. Osler has described. The first was a girl 18 years of age who had these recurrent attacks of abdominal crises at short intervals and without any relation to any food she had taken.

I saw her during one of the attacks and was struck by the peculiar attitudes she struck in writhing during her agony. The next morning she was covered with the typical erythema, which disappeared within three or four hours.

The second case is especially interesting to me, in so much as an attack of this nature followed the injection of 1500 units of diphtheria antitoxine. The attack came on eight days after the administration, the first symptoms being violent epigastric pains, followed in a few hours by a general urticaria associated with erythema. There was well-marked œdema of both eyelids, a rise of temperature to 103 F., which subsided with the amelioration of symptoms. The duration of the attack was about 20 hours. The various sequelæ which often follow the administration of drugs, like quinine, etc., together with diphtheria antitoxine, form a group of cases that are similar in many respects to those mentioned to-night.

DR. MCCRAE.—There is one point mentioned by Dr. Fox, namely, the association of constipation with the pain, that I wish to speak of. We have had a great deal of difficulty in moving the bowels of these patients and as soon as we succeeded the pain ceased. It may be that free purgation influences the condition and not that the purgation begins only when the pain is controlled. It is an interesting point in regard to the question of treatment. Certainly there is no doubt about the difficulty of purging these patients.

Immunization of Bacillus Dysenteriae by Growth in Agglutinating Serum. DRS. MARSHALL and KNOX.

MAY 2, 1904.

The meeting was called to order at 8 P. M., with Dr. Futcher, President, in the chair.

The Treatment of Delirium Tremens and Allied Conditions. DR. ALEXANDER LAMBERT, New York. [To appear in a future number.]

DISCUSSION.

DR. WELCH.—Dr. Lambert is to be congratulated upon the valuable use which he has made of the unequalled opportunities for the study of alcoholism in Bellevue Hospital. He has referred to the attempts which have been made to approach this subject from the experimental side. Probably the most extensive and prolonged series of experiments upon the pathological effects of alcohol are those which were conducted here in Baltimore by Dr. Friedenwald in behalf of the Committee of Fifty, the main results of which have been published in the two volumes of the report of the Physiological Sub-committee. Like most other experimenters we were unable to produce experimentally the most characteristic, although not the most common, of the morbid lesions of alcoholism, namely cirrhosis of the liver. This negative result cannot be attributed to the short duration of the experiments or to the small quantity of alcohol consumed. It speaks in favor of the view that alcohol acts indirectly in the causation of cirrhosis, the lesion of the liver not being referable to the immediate and direct toxic action of this agent upon this organ.

Dr. Friedenwald noted extraordinary individual variations in the susceptibility to alcohol on the part of rabbits. Whereas certain animals succumbed quickly to repeated daily intoxicating doses of alcohol, others could be kept alive for at least four years under these circumstances without presenting serious anatomical changes.

The most common lesion which was produced experimentally was a fatty metamorphosis of the cells of the liver, the heart muscle and the kidneys. This lesion quickly disappeared after stopping the alcohol. I am not inclined to attach as much clinical importance to the occurrence of fatty degeneration of the cardiac muscle as Dr. Lambert seems to do. This condition cannot be brought into definite relation with the symptoms which it was formerly customary to assign to it. Several years ago in my studies of the general pathology of fever I demonstrated that high degrees of fatty degeneration of the heart muscle could be produced experimentally in rabbits without apparent serious impairment of the force and functional activity of the heart. Of course there may occur such extreme degrees of fatty degeneration of the heart-muscle that it must be supposed that the function of the muscle is seriously injured, but these are relatively infrequent cases. It is now known that most of the symptoms which were formerly attributed to fatty degeneration of the heart are the result of disease of the coronary arteries or of some form of myocarditis, and we also know that a very painstaking examination may be required to reveal some of the significant myocardial lesions. We must, however, admit that there may occur serious functional disturbances of the force and action of the cardiac muscles without definite pathological changes of the heart which we can demonstrate. In these cases there may or may not be fatty degeneration of the muscle, and, as it well known, this degeneration often enough occurs without any symptoms referable to the heart. Of course fatty overgrowth is a quite different condition from so-called fatty degeneration of the heart, and may be a serious affection in alcoholics, especially in beer-drinkers.

Inasmuch as the special poisonous action of alcohol is primarily upon the higher nervous centers, the morbid changes of the nervous system in alcoholism are of especial interest. We should distinguish between those pathological lesions of the brain, such as thickening, opacity and adhesions of the membranes, chronic pachymeningitis, œdema of the brain and meninges, granular ependymitis, atheromatous arteries, etc., which are common in chronic alcoholism, but which are not responsible for the destructive cerebral symptoms of alcoholic intoxication, and those more delicate changes of the nerve-cells and their processes revealed by the Golgi, Marchi and other refined methods. These latter changes can be produced experimentally, as was shown in Friedenwald's experiments, but, as is well known, it is very difficult at present to utilize these findings in explaining the alcoholic psychoses.

One of the most interesting outcomes of recent investigations has been to correlate the various distinctive alcoholic diseases of the brain, the spinal cord and the peripheral nerves on the basis of the neurone doctrine, the underlying condition being a toxæmia induced by alcoholic excess and manifested now in one part of the neurone system and now in another part, it may be in the form of a peripheral neuritis, or of delirium tremens, or of Korsakow's psychosis, or of acute hallucinatory mania, or of alcoholic epilepsy.

Dr. Paton.—Dr. Lambert certainly deserves a great deal of credit for this excellent work. He has brought up a number of interesting points, some of which are still the subject of controversy. First, as regards the matter of prognosis and treatment: it is believed that the cases having simple visual or haptic hallucinations generally recover. If auditory hallucinations occur the case is believed to be of a more severe type. As soon as ideas of reference develop the course will probably be a protracted one and marked disturbances in the organic sensibility do not as a rule indicate a favorable outcome. The ordinary case of delirium tremens in certain ways resembles a typical case of mania. Every idea that crops up in the patient's mind is of equal value with the one that precedes it, so that there is a leveling off of ideas.

I should like to ask the doctor if he has had any experience with the prolonged bath in these cases?

Dr. Lambert.—In taking up the remarks that have been made, those of Dr. Welch concerning the fatty degeneration are of considerable interest. What first led me to pay attention to the condition of the heart muscle was the large number of young women and men who dropped dead suddenly and where the post mortem showed no reason for the death except the drinking. I recall the case of one man, a young man of twenty-one or two, who had only been drinking that morning. He dropped dead on walking across the ward. I have never seen a more normal set of organs than were found in that man. Working in the morgue where all the coroners make their autopsies, we puzzled over the many young women especially, brought up from the Bowery, who had walked out of a saloon and dropped dead in front of it. These cases invariably have fatty degeneration of the heart muscle, and usually that is the only lesion to be found. That a person can get over this condition I know very well from clinical observation. On stopping the alcohol they recover, and the ability to climb hills, etc., soon returns. I have seen many autopsies where no one could tell the cause of death, and yet it seemed to be due to sudden cardiac failure. I know that unless the heart is stimulated in delirium tremens, and careful attention paid to the cardiac and circulatory system, you will lose a larger percentage of cases than is so otherwise.

Dr. Paton's question about the different hallucinations is very hard to answer. As to the continued baths, I have not tried them. We have so many patients that it is impossible. We have found the sprinkle baths, however, very necessary in the summer. As to the hallucinations, I have not gone into that here. I have some three hundred accurately recorded kinds. An interesting point is the manner in which the hallucinations accord with the occupations of the patients. One, for instance, complained that he was being crowded by the elephants. On asking him if he was a circus man, we ascertained that he was a keeper of the elephants in a circus. Another, who was a vegetable carrier, has his vision filled with blue potatoes. The primary colors predominate in these hallucinations, and usually blue seems to predominate over the others. With drivers of horses the hallucination that the horses are backing with him is believed to be a very bad sign. There is no doubt that some individuals have a very marked tolerance for alcohol, in their nervous systems and in the other parts of the organism.

As to Dr. Thayer's question about the use of ergot, I have used it in acute diseases, in typhoid and in pneumonia. My death rate has been lower in pneumonia with its use than ever before, the difference being about 10 per cent. When I stopped ergot the death rate rose about 10 per cent. It is a drug that I took up with much skepticism and for which I have come to have a great deal of respect.

May 16, 1904.

Meeting called to order at 8 P. M., with Dr. Futcher in the chair.

The Blood in Pregnancy. W. L. Thompson.

(See June Bulletin, page 205.)

Discussion.

Dr. Emerson.—Mr. Thompson is to be congratulated on this new piece of blood work. What we need is a few cases well studied rather than a great many with less thorough observation. The results obtained in this investigation are certainly very interesting, especially that concerning specific gravity, because that has not been so well worked out and because the curve for that is more regular. That is the most interesting part of the paper and I congratulate him on his successful work.

The Pathology and Treatment of Benign Tumors of Bone with Cyst Formation. Dr. Halsted.

Dr. Halsted exhibited a child, a native of the United States, aged 7 years, who was admitted to the Johns Hopkins Hospital on January 18, 1904, with the following history: He had been a healthy child until June, 1899, when he fractured his left thigh just below the trochanter by a fall. He was placed in bed and a long lateral splint was applied for three weeks. When the splint was removed, a swelling was apparent which gradually increased. When he began to walk without crutches, he walked with a limp and had occasional spells of weakness when he could not walk at all. Ten days before admission to the hospital he injured the leg again and was not able to walk upon it at the time of his admission. There was a marked swelling at the junction of the middle and upper third of the thigh extending into the trochanter. The diseased thigh was from 1 to 2.5 cm. greater in circumference than the opposite thigh and Bryant's line was 1 cm. shorter on the injured side. There were no crepitus, no point of false motion, and little tenderness over the tumor.

By means of the skiagraph a diagnosis of a benign tumor of bone with a cyst formation was made. After chiseling out a piece of bone, a small cyst containing a brownish fluid was entered. Upon further exploration a mass of new growth was found occupying the medullary canal. This was shelled out down to a point well below the disease. The bone was then cut through and the head of the femur was enucleated but the limb was not amputated. The patient made a good recovery and could walk in five or six weeks. A skiagraph made several weeks after the operation shows that the bone is being reproduced and a perceptible increase in the amount of bone in the region occupied by the cyst.

Pulmonary Distomatosis in Man (Presented by Dr. Emerson). Dr. C. Wardell Stiles. (Lantern Slides and Microscopic Exhibit.)

Dr. Stiles asked me to express to this Society his regret that he cannot in person present this very interesting and important case. I am happy that he has kindly authorized me to show the specimen, and take this opportunity to express our appreciation that we may study this rare case. It is the sputum of a case of pulmonary distomatosis, a case of Dr. McKenzie, of Portland, Oregon, and the first to be discovered in man in America.

Dr. Stiles also sends this portion of the lung of an infected hog, which shows the adult worms, and some lantern slides. The disease has been found in several animals in this country, and, so far as can be determined, it is in all cases the same parasite.

The disease is very common in some countries, especially in some parts of China, Japan and Korea. It is said that some entire villages are infected, and the inhabitants of one village will have nothing to do with those of an infected place. The guess of a native was that about fifteen per cent of his acquaintances were infected. This is a case imported from Japan.

The only symptom is hemoptosis (unless the brain be involved, in which case Jacksonian epilepsy); at first only a few drops of blood, then more profuse and more frequent until the patient dies from anemia. In the periods between these the sputum is of a rusty color, and not due as in pneumonia to changes in the hæmoglobin, but to the presence of these eggs themselves. In this connection I should emphasize the importance of examining fresh specimens of sputum. It is customary with students to examine only stained specimen of sputum and usually only with the idea of finding tubercle bacilli. Hence these eggs would never be discovered. In doubtful cases of hemoptosis, therefore, examination of the sputum in the fresh stage should be made. (Lantern slides.)

CORRESPONDENCE.

LEGISLATION AGAINST TUBERCULOSIS.

To the Editor:—I wish to add a postscript to the statement in the "Report of Results of Nursing Dispensary Tubercular Patients" which appeared in the May Bulletin, as to the failure of our health authorities to secure legislation to prevent the spread of tuberculosis. Since this Report was written, through the efforts of the Tuberculosis Commission of Maryland, the Legislature has passed an excellent law which has received the approval of the Governor. This provides for a compulsory notification of cases and deaths under penalty of a fine. Fumigation of an infected house, on the part of a landlord, before it can be let again, is also made compulsory under a fine of $25 if the law is not complied with. With this legislation Maryland can now be considered of the most advanced States in the crusade against tuberculosis.

Reba Thelin,

Visiting Nurse Johns Hopkins Hospital Tuberculosis Clinic.

NOTES ON NEW BOOKS.

Treatise on Diseases of the Skin. By Henry W. Stelwagon, M. D., Ph. D., Clinical Professor of Dermatology, Jefferson Medical College and Woman's Medical College, Philadelphia. Third edition. With 220 illustrations in the text, 26 full-page lithograph and half-tone plates. (*New York, Philadelphia and London: W. B. Saunders & Co., 1904.*)

The necessity for a third edition of this work, within eighteen months, testifies to its excellence and to the need for a textbook on dermatology combining an abundance of good illustrations with a well written text.

While no material changes have been made in the new edition, the author has availed himself of the opportunity to revise and enlarge the methods of treating special diseases.

A short paragraph tells of the therapeutic value of both sun and electric light in psoriasis. Relapses, however, are quite frequent following the use of Roentgen rays.

The occasional brilliant results of the action of these rays on obstinate cases of acne vulgaris is noted and directions are given for their use. A measure of success has also attended the repeated application of high frequency currents in this disease.

The X-ray treatment of carcinoma cutis has been revised. The author advises its use until a "mild erythema or even decided dermatitis" is produced.

One sentence, however, is significant of the conservatism with which he regards the value of these rays. He says: "It is usually slow, and probably future observations will show that its special field of usefulness will be as an immediate supplementary measure to those already practiced and described above."

The reported favorable influence on cancerous growths following the application of radium is mentioned, but personal knowledge is wanting.

The treatment of lupus vulgaris and lupus erythematosus by the Finsen light, Roentgen rays and radium also shows the results of the author's efforts to bring the book abreast of the times.

Dr. Stelwagon is to be congratulated for the well merited success which the treatise has achieved.

A System of Physiologic Therapeutics. Edited by Solomon Solis Cohen, A. M., M. D. Vol. VII. Mechanotherapy and Physical Education. Part I. Massage and Exercise. By John K. Mitchell, M. D., Physician to the Philadelphia Orthopedic Hospital and Infirmary for Nervous Diseases. Part II. Physical Education by Muscular Exercise. By Luther Halsey Gulick, M. D., Director of Physical Training in the Public Schools of Greater New York. (*Philadelphia: P. Blakiston's Son & Co., 1904.*)

This volume opens with "Massage and Exercise," by Dr. John K. Mitchell.

The use of physical methods, as a remedial measure, has in recent years grown extensively in importance, but authoritative literature on the subject has been meagre. The appearance, therefore, of this treatise, coming from a physician whose name has long been connected with the subject, is an occurrence of special interest to the medical profession.

The book consists of two sections. The first of these treats of the "Principles, Methods and Therapeutics of Massage." A detailed and especially thorough consideration is given here to the diseases and conditions, both general and local, for which massage is deemed useful. Practical notes as to the methods to be followed and the selection of manipulations to be made are included in the description of each case.

Numerous details of practical interest, together with excellent descriptive illustrations, render the book useful to the masseur and student of massage, as well as of interest to the physician and surgeon.

One adverse criticism, however, must be made; namely, as to the definitions given of the fundamental manipulations of massage (pp. 22-23). These, it is believed, are intended by the author to be merely suggestive to the physician, rather than elaborated for the guidance of the masseur. Yet, because of the urgent demand for a wholly practical treatise upon massage, and because Dr. Mitchell's breadth of experience in this line of work will give to his book the weight of authority, it is to be regretted that these descriptions are not more complete, indeed, that they are lacking in essential points. For example, in the description of "circular friction," the fact which is indeed the basis of the whole movement, namely, that the fingers do not move over the skin, is omitted; in "pétrissage" (kneading), a manipulation in which this feature is also a distinctive part, the fact is named, but the reason given is a secondary one of dragging the hair upon the surface, and not the essential reason that if the hand moves over the skin its force is dissipated superficially and is not directed wholly to the underlying tissues.

Again, in the description of "effleurage" (stroking) only one form of the manipulation is named, and this is a somewhat elaborate stroke, which is indeed of special value upon normal surfaces, but which, it is usually conceded, is not otherwise as essential a manipulation as are simpler strokes that have not been described.

The second section, which is somewhat the larger part of the book, is entitled "Exercise as a Remedial Measure." This includes a description of helpful forms of exercise and of the various schools of physical culture, with explanations and comments. To these is added a discussion of the forms of exercise which have proved desirable as therapeutic agents in the treatment of special conditions, such as of obesity; gout; of spinal curvature and other deformities.

A chapter is devoted to exercise in the treatment of heart disease, outlining the Schott and Vertel systems. Numerous illustrations are included in this section also, and will be found useful aids in explaining the text in detail.

Special commendation should be given to the careful manner in which exercises are graded for convalescent patients.

The book is characterized by clearness of thought and moderation of statement, and as a whole is a valuable contribution to medical science.

American Edition of Nothnagel's Practice. Tuberculosis and Acute General Miliary Tuberculosis. By Dr. G. Cornet, of Berlin. Edited with additions by Walter B. James, M. D., Professor of the Practice of Medicine in the College of Physicians and Surgeons, Columbia University, New York. (*Philadelphia, New York and London: W. B. Saunders & Co., 1904.*)

There is probably no more difficult subject on which to write clearly than that of tuberculosis. The discussion of a disease with so many features about which there are so many debatable points can never be an easy matter. It seems to us that Professor Cornet has succeeded fully. The book as a whole is characterized by clearness, and the various points under discussion are dealt with in an able manner. The editor of this volume is Dr. Walter B. James, of New York, who has done his work extremely well. He notes in the preface that Dr. E. R. Baldwin has contributed a special chapter on the chemistry of the tubercle bacillus.

The volume opens with an excellent short historical review of tuberculosis. The morphology of the tubercle bacillus is then described and there is an admirable section on differentiation between the tubercle and the smegma bacillus. Th importance of distinguishing the tubercle from the pseudo-tubercle bacillus cannot be too strongly emphasized, especially in the diagnosis of renal and bladder conditions. Dr. Baldwin's chapter on the chemistry of the bacillus is complete and clear. There is an adequate description of the occurrence of the tubercle bacillus outside the body, and full reference is made to the work which has been done in regard to its occurrence in dust and in buildings. The section on the modes of invasion of the tubercle bacillus is exhaustive. The difficulties in demonstrating the source in many cases are pointed out, and the various possible portals of entry described. The importance of infection of the tonsils is especially dwelt on. The probability and frequency of infection of the intestinal tract is gone over at length; notwithstanding one cannot but wish that the author had either summed up the subject or given his own opinion more clearly than he has done. One is hardly able to obtain a definite opinion as to the author's position in regard to the question of intestinal infection. Naturally the subject of infection through the respiratory tract is discussed at length. The author points out in an interesting way the difficulties many of the older men had in accepting the view of direct infection of the lungs. The importance of Baumgarten's work in establishing the identity of tubercle and caseous pneumonia from a histological point of view is emphasized. In explanation of the fact that the upper air-passages are usually only secondarily diseased, though more often exposed to infection, the author points out that in the upper air-passages inhaled particles of dust, etc., are very readily swept up and gotten rid of, while in the deeper situations a great deal of the dust has to be carried by the lymph channels to the bronchial glands. He points out that, as regards the elimination of foreign material, the alveoli are in an unfortunate position, both as concerns dust and tubercle bacilli. Those which penetrate to the deeper parts tend to remain permanently. He considers that the tubercle bacilli behave in the same way as inactive particles of dust. One looks with interest for an explanation of the frequency of disease of the apices, but the author does not commit himself and gives no satisfactory explanation. Under the heading of infection of the pleura, the author considers that this is almost always secondary. We should like to modify his statement that "the demonstration of tubercle bacilli in the pleural exudate is *rarely possible*." This is very largely a matter of the way in which they are looked for and the care which is taken. With the precipitation and digestion of the clot of the pleural exudate the tubercle bacilli, with careful search, can be found in many of the cases. The editor notes this point, and we are able from experience to speak of its value. In the consideration of infection of the urogenital tract, the author lays a great deal of stress on the infections from without. Glandular infection is discussed at length. The next chapter is on the whole question of infection, which is discussed fully. It is comforting to find that the author considers the risk of infection from coughing to be very slight. Heredity and predisposition are next discussed, and the uselessness of drawing conclusions from small figures is strongly emphasized. "Statistics is the law of great figures."

The second part of the book is devoted to pulmonary tuberculosis. It is impossible to review this portion in any detail. The whole discussion will be found most satisfactory. The symptoms and diagnosis are fully taken up, together with the prophylaxis and treatment. We would like to comment on the clear and definite way in which, throughout this entire section, special rules for treatment are laid down. This is a most important point. So many writers are content to merely give general directions, trusting to the intelligence of the readers to interpret them correctly.

The latter part of the book is taken up with a discussion of acute general miliary tuberculosis. In the opening section the author speaks of the difficulty of an explanation of the fact that general miliary infection does not occur in every case with a caseous focus. The importance of the relationship between tuberculosis of the blood-vessels and miliary tuberculosis is emphasized. The writer does not consider that there is any evidence suggesting that tubercle bacilli multiply in the blood. The differentiation of miliary tuberculosis from typhoid fever is discussed fully.

The volume contains a bibliography of nearly one hundred pages. As a whole the book is an exceedingly satisfactory one, and especially so in the clear, direct style in which the greater part of it is written. The additions of the editor are timely and have been put in with judgment.

American Edition of Nothnagel's Practice. Diseases of the Intestines and Peritoneum. By Dr. Herman Nothnagel, of Vienna. Edited with additions by Dr. H. D. Rolleston, of London. (*Philadelphia, New York and London: W. B. Saunders & Co., 1904.*)

In reviewing the previous volumes of the American Edition of Nothnagel's Practice, we have had occasion to criticize the method in which the translation has been done. In this volume it is a pleasure to note that the translation has been very much better done and that the text throughout reads clearly. The credit for this, we rather suspect, is due to the editor, Dr. Rolleston. As is the case with many of these volumes, the present one is more suitable as a reference than as a text-book. The German authors, as a rule, run to diffuseness, and the obtaining of a clear, comprehensive view of any subject is apt to be more or less difficult from their works.

Throughout this volume there is considerable attention paid to the anatomy of the various conditions discussed, which we regard as a very valuable feature. The volume opens with a discussion of the chemical processes and the different bacteria of the intestine. Here, as elsewhere throughout the work, Dr. Rolleston has paid particular attention to the English and American literature, and it is interesting to observe what a considerable part it plays, particularly in the discussion of the bacteria of the intestine. Various conditions associated with mucus in the stools, fatty stools, etc., are discussed, and there is an interesting section on Intestinal Sand. Constipation is considered at some length. The discussion of the treatment is taken up under (1) dietetic; (2) physical; (3) medicinal. Under the second heading we are rather surprised to see that both walking and horseback riding are referred to as not having any special value in the author's experience.

The discussion of diarrhœa is interesting. The author describes a number of different types, which we should consider rather unnecessary, but the tendency towards elaborate classification and the multiplication of terms seems to be almost inherent in many of the writers on gastro-intestinal diseases.

Intestinal pain and intestinal hæmorrhage are discussed, and there is a considerable section devoted to catarrh of the intestine. One looks through this section with some interest to find out exactly what the author means by this term, but there does not appear to be any very satisfactory answer. A distinction is made between diarrhœa and catarrh; exactly what, it is hard to say. It is interesting to find the expression, "idiopathic rheumatic catarrh," used as a synonym for acute catarrh of the intestine. It is rather difficult to understand exactly the reason for this term.

The discussion of mucous colitis is very satisfactory. In the consideration of treatment, the author hardly seems to lay enough stress on the treatment of the patient's general condition, although he notes the necessity of this. The value of bowel irrigations is referred to. Ulceration of the intestine, as might be expected, is thoroughly discussed and many of the uncommon causes for it are noted.

The section on Stenosis and Occlusion of the Intestine is one of the most interesting parts of the book. This has been discussed at great length, and Dr. Rolleston mentions in the preface that he has had the aid of Mr. D'Arcy Power in the section on Intussusception. It is impossible to note all the features of this section, but some interesting points may be brought out. One is in regard to the use of the term "ileus." As is noted, there is no uniform definition of this term. The author defines "ileus" as the "symptom-complex produced when the passage of fecal matter through the bowel is completely interfered with." Many writers, however, use the term "ileus" only in cases of obstruction which are accompanied by fecal vomiting. As Professor Nothnagel remarks, there will be no harm done if the term "ileus" is eliminated from our nomenclature.

The section on the Diagnosis of Intestinal Obstruction is exceedingly good. One sees with pleasure that it is opened with the old rule that in every suspicious case there should be a careful examination of all the possible hernial rings and the rectum. It is not necessary to emphasize the unfortunate results that have followed from neglect of this rule. One of the chief problems discussed under diagnosis is as to whether the lesion is in the small or large intestine, and in association with this there are a number of very excellent plates exhibiting various patterns of abdominal conditions. Some of these are extremely good and they add greatly to the value of the work. An interesting point in the diagnosis of the seat of obstruction is the percussion note found in the upper lumbar region. The finding of a loud percussion note in this region the author regards as suggesting a stenosis of the large bowel. It would take too long to review at length the section on Diagnosis, but it can be recommended to all who are interested in the subject. In the section on Treatment, non-operative methods are discussed at some length, and the value of lavage of the stomach is highly recommended. The author points out that about one-third of all the cases of obstruction recover without operative interference. The indications for operation are well discussed. There is a section on Ascites and then follows a section on Peritonitis.

One turns with interest to the discussion of Appendicitis. The author seems to take a very sane, common-sense view of the question. Writing as a physician, he points out the difficulties in regard to treatment and the debatable points as to when cases should be operated upon. He lays emphasis on the fact that the indications for surgical treatment should be made more concise. Thus far, such a demand seems to be asking a little too much of the surgeons, for evidence of which witness the annual discussions in the Surgical Section of the American Medical Association. In the decision of the question of operation, cases are divided into groups. This is probably the most satisfactory way of dealing with the matter. As the author says, it is impossible to lay down general rules that will apply to particular cases. A discussion of the various forms of chronic peritonitis follows. In connection with tuberculous peritonitis, the author speaks very positively regarding the diagnosis, inasmuch as a case regarded as tuberculous peritonitis is rarely found to be anything else, although the disease is often found at post-mortem when it was not suspected during life. He notes the importance of recognizing the combination of a pleurisy or pericarditis with peritonitis. Operative treatment is not recommended strongly

The book as a whole is a most satisfactory one. We must congratulate Dr. Rolleston on his work as editor. His additions are most valuable, and he has done what is most essential from our point of view in editing a foreign work, the giving of due credit to British and American investigation. It is a pleasure to see how carefully he has gone over the American literature.

A System of Physiologic Therapeutics. Edited by Solomon Solis Cohen, A. M., M. D. Vol. VIII. Rest, Mental Therapeutics, Suggestion. By Francis X. Dercum, M. D., Ph. D., Professor of Nervous and Mental Diseases in the Jefferson Medical College. (*Philadelphia: P. Blakiston's Son & Co., 1904.*)

In these days, when the profession talks very glibly of the "rest cure," sometimes, perhaps, not knowing exactly what is meant, a book such as this should be very valuable. As the title suggests, Dr. Dercum has divided the work into three parts, the first of which is devoted to the discussion of Rest. He describes first the various disturbances of function which occur, the chapter on which we think might perhaps have been elaborated to some advantage. He then proceeds to the discussion of what he calls "chronic fatigue" or "fatigue neurosis," both excellent terms, and lays special emphasis on the feeling of exhaustion.

Turning to the subject of Rest, he takes up first the partial rest methods, which seem very important. Many patients are quite unable to take an absolute rest cure, and must go on making the best of their surroundings. Dr. Dercum has laid out a very good régime for such patients. The radical treatment of neurasthenia is described at considerable length. We should recommend that this section be read by all those who are learning the handling of these patients. We are glad to see that the necessity of a proper mode of life after restoration to health is insisted upon. For the majority of these patients should be emphasized the fact that "work is the best guarantee of mental and physical health." This, of course, applies to many, but is not of invariable application. Some of our patients have "taken to work much as they would to dram drinking"—to quote the words of Huxley—and it is important to see that their labors are lessened. The treatment of conditions associated with neurasthenia is very well given, and the special modifications required in middle and advanced life are discussed. Under the heading of the Neurasthenoid States, Dr. Dercum emphasizes the importance of having a clear idea of what neurasthenia is. There are many conditions which do not really amount to the well-defined disease, but which are neurasthenoid states. As a necessary feature of neurasthenia he insists upon the presence of chronic fatigue.

Hysteria is then taken up and the essential features described. The necessity of a careful study of the patient is emphasized. The importance of the personal attitude of the physician is referred to, and the usual treatment is described. The next section is upon Hypochondria. To-day this condition receives very slight attention, and the probability is that, in comparison with neurasthenia and hysteria, it occurs very rarely. The positive diagnosis of hypochondria is not always an easy matter. The outlook in these cases, as Dr. Dercum notes, is often unfavorable. It seems to us that Dr. Dercum has included under this heading many cases which would more properly go under neurasthenia. The application of rest methods in various other neurological conditions, such as chorea, epilepsy, etc., is discussed.

The second part of the book is devoted to the Therapeutics of Mental Disease. The prophylactic measures are noted and the general principles are taken up. The merits of the rest treatment in the different forms of mental disease are discussed at some length. The indications for treatment and the methods are very clearly described. Under the heading of the treatment of the drug habits, rest is insisted upon in cases of chronic alcoholism, morphinism, etc. Naturally there remains a great deal to be added to the mere rest treatment. Under the head of cerebral symptoms from lead poisoning, the use of the iodids in ascending doses is advised. We do not think that such a statement should go by without qualification. In the more acute forms of poisoning, very much harm may be done and acute symptoms precipitated by the giving of large doses of potassium iodid. It is probably safer in many of the acute cases not to give iodid in any dose for a time.

The third section of the book deals with the use of Suggestion. The historical side is discussed in an interesting way and the various methods of hypnosis are described. The author does not speak especially enthusiastically regarding this method of treatment.

The style throughout is clear, the various therapeutic measures are well described, and the book can be recommended, especially to those who are beginning the handling of patients in whom rest is indicated.

A System of Practical Surgery. By Prof. E. von Bergmann, M. D., Prof. P. von Bruns, M. D., and Prof. J. von Mikulicz, M. D. Volume I. Surgery of the Head. Translated and edited by William T. Bull, M. D., Columbia University, and Walton Martin, M. D., Columbia University. (*New York and Philadelphia: Lea Brothers & Co., 1904.*)

An English edition of Bergmann, Bruns and Mikulicz's "Handbuch der praktischen Chirurgie" will be welcomed by those who have not had access to the original work, as well as by those who are deficient in foreign languages. The present volume, dealing with the head, is the first of four large books which after the fashion of "systems" that have already appeared in English by English and American authors will endeavor to cover the entire field of surgery.

The names of Bergmann, Krause, Krönlein, Kümmel, Kütterer, Lexer, Schlatter and Wiesmann that make up the list of contributors to this volume are a sufficient guarantee of the excellence of the material comprising the several chapters. The particular subjects with which their names are already familiarly associated have been extensively reveiwed by one or another of these well-known writers.

The editor of the present edition expresses his conviction that the volumes "will be found of inestimable value to the student and the scientific surgeon" and there can be no doubt of the truth of this statement. From the student's standpoint, however, the ideal text-book is yet to appear, and valuable as are these volumes they will unfortunately be over the heads and beyond the means of the average undergraduate. The "scientific surgeon" will seriously miss two features which he might have expected to appear in this American translation. One is the introduction into the context of the more recent American contributions on the various subjects dealt with. If this has been done at all, the additions have been so fused with the original articles as to render them indistinguishable. Still more to be regretted is the omission of the important bibliographical references which accompanied the chapters of the German edition, one of its most valuable features. It is greatly to be hoped that this loss will not characterize the ensuing volume.

The German method of italicizing important words, sentences or passages which enable the reader to quickly gather the main facts presented, and also of printing the paragraphs of minor importance in smaller text than the main subject-matter when the context is to be more studiously gone over, are features which could well be imitated by American publishers of scientific works.

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THE TRAINING OF THE SURGEON.[1]

BY WILLIAM STEWART HALSTED, M. D., Hon. F. R. C. S. (Lond.),
Professor of Surgery, The Johns Hopkins University.

Pain, hemorrhage, infection, the three great evils which had always embittered the practice of surgery and checked its progress, were, in a moment, in a quarter of a century (1846-1873) robbed of their terrors.[2] A new era had dawned; and in the thirty years which have elapsed since the graduation of the class of 1874 from Yale, probably more has been accomplished to place surgery on a truly scientific basis than in all the centuries which had preceded this wondrous period. The *macula levis notæ* clung to surgeons the world over until the beginning of the nineteenth century, although distinguished and scholarly men, as well as charlatans and barbers, have practiced the art in almost unbroken succession from the time of Hippocrates (460-375 B. C.) to the present day. A warning for all time against satisfaction with present achievement and blindness to the possibilities of future development is the imperishable prophecy of the famous French surgeon, Baron Boyer, who over a hundred years ago declared that surgery had then reached almost, if not actually, the highest degree of perfection of which it was capable.[3]

Tempted to belittle by comparisons the performances of our progenitors, we should remember that the condition of surgery has at all times reflected the knowledge and thought of the ablest minds in the profession. We may well recall the admonition so gently given by the highly talented von Volkmann, who was also a popular poet, writing under the pseudonym of Richard Leander,

> "Hoch aufhebt Schnee-schimmernd das Haupt in die Wolken
> die Jungfrau,
> Aber sie deckt mit dem Fuss ein unendliches Land."

Surgery, like other branches of the healing art, has followed in its progress zigzag paths, often difficult to trace. Now it has seemed to advance by orderly steps or through the influence of some master mind even by bounds; again it has stumbled apparently only from error to error, or has even receded; often there has appeared some invention or discovery for which the time was not ripe and which had to await for its fruitful application or perhaps its rediscovery a more favorable period, it might be centuries later.

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[1] The Annual Address in Medicine delivered at Yale University, June 27, 1904.

[2] Verhandlungen der deutschen Ges. f. Chirurgie, 1896, von Esmarch.

[3] Could Boyer, we ask, have been satisfied with the status of surgery when anæsthesia was undiscovered, when hemorrhage was awkwardly and insufficiently controlled, when infection of wounds was not understood and could not be prevented? And yet I might quote from the writings of distinguished men of our time to show that even to-day some think that surgery is almost complete. Anæsthesia, one of the greatest blessings, is at the same time one of our greatest reproaches, hemorrhage is still awkwardly checked, and of surgical infection once started we have often little control and then mainly by means of the knife. We have reason to hope that the day will come when hemorrhage will be controlled by a quicker procedure than the awkward, time-consuming ligature; when infections will be controlled by specific products of the laboratory; and when pain will be prevented by a drug which will have an affinity only for the definite sensory cells which it is desirable it should affect. The first of these may be last and the last first. Let us trust that it may, as Gross expresses it, "be a long time before the laws of this department of the healing art will be as immutable as those of the Medes and Persians."

"Literature," said Horace Walpole, "has many revolutions; if an author could rise from the dead after a hundred years what would be his surprise at the adventures of his work." Gross recognized, not altogether without regret, that this was particularly true of scientific works however erudite they may be. "Few survive their authors."[4]

[4] Gross. Autobiography, Vol. I, p. 140.

There is a most intimate interdependence of physiology, pathology and surgery. Without progress in physiology and pathology, surgery could advance but little, and surgery has paid this debt by contributing much to the knowledge of the pathologist and physiologist, never more than at the present time. Harvey's immortal discovery marks an epoch for surgery, as it does for all medicine, for without knowledge of the circulation of the blood only the most primitive kind of surgery is thinkable. And yet there is abundant proof that the ligation of vessels, with the introduction of which Ambrose Paré (1517-90) has until recently been accredited, was known to the school of Alexandria; carried, it is said, to Rome by Euelpistus, it is mentioned by nearly all surgical writers of importance from Celsus to the Renaissance. The brilliant Fallopius (1523-62), Paré's contemporary, alas a very short-lived one, wrote much about the use of the ligature for the arrest of hemorrhage. Nevertheless, until Harvey demonstrated (1628) the true course of the blood, the principles underlying the control of bleeding by the ligature could not be understood, and surgeons studiously avoided operations which entailed hemorrhage and necessitated its control.

We can hardly understand in these days that surgeons who were at the same time anatomists and physiologists could have accepted for so many centuries, almost without remonstrance, Galen's views. Our inability to comprehend their state of mind with reference to this problem illustrates particularly well the difficulty experienced when we attempt to transport ourselves to other times, to obtain the point of view which subjugated our forefathers of centuries ago. It is now, as it was then and as it may ever be; conceptions from the past blind us to facts which almost slap us in the face. The blood which spurted from the divided artery was believed to come not from the left heart, but in some mysterious and indirect way from the veins, in which it was supposed to flow and ebb to and from the right heart. Harvey knew nothing of the paths by which the arterial and venous systems communicate, and his discovery was not made complete until Malpighi in 1661 demonstrated by the microscope the capillaries.

How bewildering hemorrhage must have been when a wound suddenly filled with blood from a source unknown, and when sometimes, with little bleeding, a patient suddenly died from aspiration of air into the veins! What more natural than to pack quickly the wound, as Heliodorus and others were wont to do, with compresses of lint or sponge, to ligate large masses of tissue by circumvection, to draw the bleeding edges of a wound tightly together by stitches, as is still sometimes done, or to sear the bleeding surfaces with the cautery or with boiling oil! Imagine the terror and suffering of the patient, the desperation and haste of the surgeon, conditions not suited to the tranquil pursuit of physiological knowledge.

In all times, even to the present day, the surgeon's chief concern during an operation has been the management of the blood vessels. The fear of death on the table from hemorrhage has deterred many a charlatan and incompetent surgeon from performing otherwise perilous operations. The care exercised in the control of hemorrhage may constitute the chief difference between a rapid and a slow operator. This was eminently the case in the days within my experience when two or three artery clamps were considered abundant for operations which now require one or even two hundred.

The five things declared by Paré, usually designated as the father of French surgery, as proper to the duty of a surgeon may serve to indicate how restricted was the field of surgery before the course travelled by the blood was determined:

1. To take away that which is superfluous, as in amputations.
2. To restore to their places such things as are displaced, as in hernias.
3. To separate those things which are joined together, as in parts rendered adherent by burns.
4. To join parts which are separated, as in stitching up a wound.
5. To supply the defects of nature, as in setting an eye, an ear, a nose, or one or more teeth; filling up the hollowness of a defective palate with a gold or silver plate.

The studies of Hunter, born just one hundred years after Harvey published (1628) his demonstration of the circulation of the blood, and about seventy years after Malpighi discovered the capillaries, on the healing of wounds, on inflammation, on the ligation of arteries, were made possible by the discoveries of these great investigators. John Hunter's (1728-1793) name is eclipsed by that of no other surgeon, and for the fame of his contributions, particularly to biology and physiology, an inextinguishable lamp will forever burn. Let us remain with him, if only for a moment, for he is an inspiration and a teacher for us all, as great perhaps for his time as the world has seen or will ever see again.

How fascinating to follow the groping in the dark and the searching for the light of a great mind! How refreshing and what a lesson is his honest doubt! "I am not able under such circumstances," he writes,[5] decidedly to say which is the best practice, whether to leave the slough to separate, or to make a small opening and allow the blood to escape slowly from the cavity." And again, speaking of that common class of injuries in which the wound communicates externally and the blood has formed a scab over the breach, he says:[6] "But this operation of nature reduces the injury to the state of a mere superficial wound, and the blood which is continued from the scab to the more deeply seated parts, *retaining its living principle* [italics mine], just as the natural parts do at the bottom of a superficial wound, the skin is formed under the scab in the one case as in the other; yet if the scab should either irritate or a part underneath lose its uniting powers, then inflammation and even sometimes suppuration may be produced." Here Hunter recognizes facts which have been fully appreciated only in recent years, that there is a power for good in the blood, that the blood clot has a value and should be undisturbed, and that the dry scab usually desirable is sometimes harmful.

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[5] Hunter, Palmer's ed., Vol. III, p. 247.
[6] Op. cit., p. 252.

Under the conditions existing until the time of Hunter near the end of the eighteenth century, it was doubtless right that the practising surgeon should have been sharply differentiated in social position and professional standing from the physician proper, the latter being equipped with all the academic knowledge of the time, the former an apprentice of the barber shops. "The reasoning of the army surgeons endured as butter in the sun," wrote Abraham a Gehema in 1690, and the army commanded the services of the best surgeons. Nevertheless, it is often refreshing to find records of sound personal observations in the writings of the old surgeons, who, rude and unlettered though they might be, were dealing with realities at a time when the minds of physicians were buried in scholastic subtleties and fruitless speculations. In the German universities, when chairs of surgery were first created, it was considered beneath the dignity of the physician who taught the doctrines of this art actually to practise it. Thus Haller (1708-77) about the middle of the eighteenth century taught, among other things, surgery both in Goettingen and Berne, but never demeaned himself to perform an operation. Billroth,[7] commenting on this arrangement, says: "That Albrecht von Haller in Berne should for many years have lectured on surgery without ever having touched a single human creature with the knife is for us, in these days, hard to comprehend." How different apparently from Haller's was the attitude of mind at that time of John Hunter (1728-93) in England, whose practice yielded a yearly income of six thousand guineas; and yet in spirit perhaps not so different after all, as exemplified by the remark to an assistant, "Well, Lynn, I must go and earn this damn guinea, or I shall be sure to want it to-morrow."

Even in America a little more than a hundred years ago a definite stigma still adhered to the exercise of the surgeon's art. Thus writes the eminent Dr. John Morgan, founder of the Medical Department of the College of Philadelphia, later the University of Pennsylvania, in a letter from London, November 10, 1764, to Dr. Cullen, after a long period of study abroad: "I am now preparing for America to see whether, after fourteen years of devotion to medicine, I can get my living without turning apothecary or practitioner of surgery."[8]

It was not until the year 1800 that the Royal College of Surgeons received its charter, and then only with great difficulty. Parliament had again and again refused to grant a new charter to the disbanded "Company of Surgeons." Lord Thurlow is reported to have said in the House of Lords when the bill had passed the Commons: "There is no more science in surgery than in butchering," and it was only when the Court of Examiners, a body still in existence, decided to appeal to the Crown, to King George III, that the charter was ultimately obtained. From the days of the great Hohenstaufen, Frederick II, who in 1231 commanded the teachers at Salernum diligently to cultivate the art of dissection, up to the present time medicine has repeatedly been aided and advanced by the enlightened intervention of kings and rulers. When Maria Theresa brought Gerhard van Swieten from Leyden to Vienna in the face of great opposition from the profession, she laid the foundations of the fame of the medical school of Vienna and she placed to her credit an achievement from which Austria and Germany still profit. In Prussia medicine has enjoyed the support of the Crown without interruption from the time of Frederick I to the present day. The splendid new equipment of the surgical department of the University of Berlin is largely the result of Emperor William II's wisdom and liberality. "A king or a privileged class," writes President Hadley,[9] "ruling in accordance with traditions and trying to act for the interests of the people, will give a much larger measure of real freedom than is possible under a democracy whose members have no respect for the past and no higher aim than their own selfish advancement."

The founding of the Academy of Surgery in Paris, in 1731, has been referred to as the turning stake in the history of surgery, as the starting line of its scientific labors and of its true career, and the French regard the five anatomical demonstrations made a few years before by the surgeon La Peyronie in the College of St. Côme as the inauguration of the new epoch. Von Bergmann reminds us that a Theatrum Anatomicum for students of surgery was erected in Berlin in 1713, but this exerted no such wide influence as the Paris Academy. The development of clinical teaching can be traced by unbroken tradition directly to Boerhaave, professor at the University of Leyden in the early part of the eighteenth century, and a teacher of unsurpassed influence and renown. His pupils carried the new methods to Austria, to Germany, to Edinburgh, and their descendants in the faith were the founders of the early medical schools in this country. In its influence upon the development of medical teaching the University of Leyden occupies historically the first position.

The relation of surgery to general medicine at the end of the eighteenth century was in Germany much less satisfactory than in Great Britain and in France. Under the teacher of clinical medicine was a surgeon who demonstrated the surgical cases. When Reil was called from Halle to Berlin in 1810 as professor of medicine, he naturally expected that the customary relations would be preserved and that Carl Ferdinand Graefe, a young protégé of Wilhelm v. Humboldt, would operate under his direction. But by a mandate from the throne the independence of Graefe and of surgery was established. Graefe was given a responsible post as army surgeon, and his services in war were of such a high order and so greatly esteemed by the King that an independent surgical clinic was soon established and entrusted to him. The first equipment of this clinic was a very modest one, conforming to the straightened condition of the state's exchequer. Five times in the first nine years of its existence his hospital of ten beds was obliged to seek new quarters, but in 1818 it was located at the site of the present surgical clinic of the University of Berlin. Philipp v. Walther, his illustrious contemporary, gives his impressions of Graefe's clinic, which he visited in 1834: "A remarkable, splendid spectacle, conducted in a dauntless and highly gifted manner is Graefe's clinic in Berlin; we have no prototype of it either in France, England, North Italy or Holland. Its disposition is entirely national, purely German." "What changes have taken place in a single generation," writes von Bergmann,[10] "changes brought about by the same indefatigable activity of the German clinical teachers and by their absolute devotion to their work, the devotion springing from innermost convictions which made it possible for Graefe after fifteen years of clinical toil to win such testimonials from his fellows."

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[7] Lehren u. Lernen, p. 45. Wien, 1876.

[8] Packard, The History of Medicine in the United States, p. 191.

[9] Arthur T. Hadley, The Relations between Freedom and Responsibility in the Evolution of Democratic Government. Chas. Scribner's Sons, 1903.

In the year 1876, the year when I first walked the wards of Bellevue Hospital, New York, the dawn of modern surgery in America had hardly begun, and it may be of interest to note some of its characteristics at that time. The discovery of ether was not so old as to have obliterated all traces of the old surgical rule, "Cito, tuto, jucunde," but the rapid method of operating was gradually giving place to the safer one. Conservative surgery was made possible by general anæsthesia, as was illustrated particularly well in the exsection of joints and the subperiosteal resection of bone. The discovery of the ophthalmoscope, an invention of incalculable importance, had led to the establishment of the specialized eye surgeon, and it soon proved a great boon to general surgery, leading as it did to the adoption of innumerable specula and mirrors for the examination of hitherto unexplored regions. As a result of a reaction against bleeding and against the reckless waste of blood at operations, there developed a fondness, almost a mania, for bloodless operations, for styptics and the actual cautery, for écrasement linéaire (Chassaignac), for galvano-puncture and electrolysis. To the employment of galvano-puncture in the treatment of arterial angiomata is due the introduction by Pravaz of the hypodermic syringe, which it is interesting to note was originally designed solely for the purpose of conveying to these growths a substance (solution of chloride of iron) capable of producing coagulation. This little instrument, destined soon to play a part so useful, so indispensable, entitles its inventor to the lasting gratitude of mankind.

None of these methods for the bloodless division of tissues was destined to supplant the knife, so that surgeons became interested in devising better means for the prevention of loss of blood. In 1873, at the German Congress of Surgeons, in Berlin, von Esmarch gave to the world his method of producing artificial bloodlessness ("die künstliche Blutlehre").[11]

But no truly great and essential progress in fundamental surgical principles had been made since Hunter's time, until the monumental labors of Pasteur opened the vista through which for a time only the eyes of Lister could peer. It is hard to realize that forty years have passed since Lister and Pasteur made to surgery a contribution rivalled only by Harvey's in importance. It was in 1867 that Lister first made known the almost incredible results of his experiments with carbolic acid in the treatment of wounds. The great merit of Lister lies in his clear recognition of the significance of Pasteur's discoveries in revealing the underlying causes of the infection of wounds and in the adoption of measures fitted to prevent and combat such infection. This merit will remain whatever changes may be made in the details of antiseptic and aseptic surgical procedures.

It was not, however, until 1875 that even in Germany Listerism obtained a substantial foothold. How I should like to tell the true story of this period in this country and abroad, to do full justice to Lister and his few faithful disciples in the United States and Great Britain, who for nearly twenty years contended with prejudice and parried the almost venomous thrusts of the skeptical and the envious.

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[10] Die Entwickelung des chirurgischen Unterrichts in Preussen. Berlin, 1893.

[11] Verhandlungen der deutschen Ges. f. Chirurgie. 1896. (The Jubilee Congress

Von Esmarch is one of the very few surgeons living who, even as a student, can recall the days before anæsthesia. He maintains that he who was not a participant of those times cannot picture to himself the enthusiasm which took possession of every physician, and particularly of the students in the surgical clinic. Whereas before the introduction of ether, the operating rooms were filled with the groans and shrieks of the unfortunate victims, the appalling spectacle causing many students to faint, now, of a sudden, absolute quiet reigns, a stillness almost supernatural, broken occasionally by the senseless chattering or joyous singing of the patient.

Familiarity with the use of cocaine in surgery has robbed somewhat the pre-anæsthesia days of their interest to the surgeon. We used to admire and wonder at the courage of the old-day surgeons who could inflict such torture for such small rewards, but we know now that certain operations can be performed with very little pain even without the employment of a local anæsthetic. It is often unnecessary to do more than anæsthetize the skin to perform a very considerable operation, in the neck for example. From cocaine we learned in one year (1885) more about the relative sensitiveness of the various tissues and organs than from all the literature of our forefathers. The skin being anæsthetized and incised, we were surprised to find that the underlying parts were comparatively insensitive to handling and, for the most part, even to cutting. The accidental cutting or crushing of nerves caused the most exquisite pain, and we noticed that the nerve supply of the blood vessels[12] is so abundant that the severing or clasping of even very small bleeding points usually startled a cry of some sort of remonstrance from the patient; and now after many years of experience with cocaine we interpret an unexpected moan as signifying an insult to some small unseen blood vessel or nerve. These facts learned, I say, in one year, perhaps in six months of experimentation with cocaine, were not clearly revealed by all the previous ages of surgery. The explanation undoubtedly lies in the facts that in olden times the first cut through the skin so unnerved the patient and perhaps the surgeon that differentiation was impossible, and that the operation was performed in such haste as to preclude careful observation. I fear that so much practice with cocaine as an anæsthetic has obtunded to some extent our sensitiveness to pain in others. Formerly it taxed one severely to employ cocaine in certain operations which we now perform with equanimity; we are in danger perhaps of acquiring the kind of immunity (it is not indifference) which it seems to me dentists possess or have cultivated to such a high degree. Briefly, then, the story of the surgery of pre-anæsthesia-days has become less interesting because it has been robbed of its terrors by the lessons which cocaine has taught us. If the surgeon of the past could only have known what it seems to the modern surgeon he should have known better than all else, namely, the relative sensitiveness of the various tissues, he could hardly have failed to discover methods of producing anæsthesia of the skin. That one could deliberately divide a nerve of the size of the sciatic or ulnar or even the minutest filaments visible without exhausting his ingenuity to find something to deaden the exquisite or agonizing pain seems inconceivable. How blind we are and how blind we ever shall be.

[12] John Hunter recognized the fact that parts richly supplied with blood were much more sensitive than the comparatively bloodless parts.

Why was Germany the country first to adopt antiseptic surgery? Why did almost every surgeon in every German university eagerly embrace Lister's system almost at the same moment and as soon as it was clearly presented? The answers to these questions are, I believe, to be sought mainly in the character of the scientific and practical training of surgeons in Germany, and it is especially upon the question of the training of surgeons that I wish to dwell in the remainder of this address. What I shall have to say relates not so much to the mere teaching of surgery in the undergraduate curriculum, as to the requirements for the training of those who desire to fit themselves for a career in surgery.

Thirty years ago as I sat upon the benches, often seven hours a day, listening to medical lectures, I was so impressed with the characters and lives of some of my teachers that I believed they represented all that was most advanced in medicine. But a day in Halle, at the clinic of Volkmann, was a revelation to me. There I heard by one of the young assistants at the early morning clinic an impromptu discourse on epithelioma at which I marvelled. At home the whole subject of tumors had been treated of in one lecture, in one hour, in the "tumor lecture." Attending the Congress of German Surgeons, which each year takes place at Eastertide in Berlin, I heard the subject of hip joint tuberculosis discussed. One surgeon alone reported on six hundred cases, more or less, some of which he had observed twenty years or longer and most of which he had been able to follow. His methods of observation were new to me; his knowledge was inspiring; I was thrilled by his masterful exposition. Within two weeks, by a strange coincidence, I found myself attending in America a meeting of a very superior "surgical society" in one of our large cities, at which the same subject, "morbus coxarius," was under consideration. Only one of the surgeons had had an experience of as many as twenty-eight cases, and of the subsequent history of most of these he knew very little. The contrast was not only in the knowledge and presentation of and interest in the subject, but in the audience. The Deutsche Gesellschaft für Chirurgie admits to its fellowship any reputable surgeon of any country of the world, and its halls at each Congress are filled and overflowing. The membership of the select "surgical society" was limited to twenty and the average attendance was less than this number.

It may be that the rise and multiplication of proprietary schools of medicine without organic connection with a university was a necessary incident in the rapid growth of a new country, but it is absurd to expect them to yield results in the education of physicians and in the advancement of knowledge comparable with those of the well-supported medical departments of European universities. It is difficult to free either the educated public or our universities from the reproach that they remained so long indifferent to the needs of higher medical education. The times are changing and we have learned in our own time, indeed within a decade, how superior in all respects is the endowed university medical school to the old-time proprietary school. Who would have believed that one or two well-utilized endowments could have achieved in so short a time so much? It was not only because some of the best men in this country were attracted to the university medical schools, fortunate enough to be so endowed, that the great progress was made; it was also because the further development of these men was made possible by the opportunities which they proffered and the atmosphere which they developed. The influence of these men, comparatively little before, almost at once, under the new auspices, was felt, not only in this country, but abroad. The growth of these men and of these schools has been so great that they are already well known and honored in all civilized countries. Much of what Welch foretold here in 1888 and in Cleveland in 1894[13] has already come to pass.

Although we now have in the United States several (five or six) moderately well-endowed medical schools with a university connection, the problem of the education of our surgeons is still unsolved. Our present methods do not by any means suffice for their training. Do we require stronger proof of the inadequacy of these methods in producing young surgeons than is presented by the so-called sacrifices which our young men to-day are willing, nay, most eager, to make in order to obtain a training which seems even to them not only desirable but absolutely essential for success of a high order? Here I may be permitted to instance conditions which have evolved in a natural way at the Johns Hopkins Hospital, where the plan of organization of the staff differs from that which obtains elsewhere in this country.[14] The average term of service for the interne on the surgical side who succeeds to the house surgeonship in this hospital is at present eight years—six years as assistant, in preparation for the position, and two years of service as actual house surgeon. Adding to these the four years in the medical school and the junior and senior years in college, which in some colleges may well in considerable part be devoted to branches introductory to the study of medicine, the prospective house surgeon has to contemplate twelve or fourteen years of hard work, very hard work, in order to secure this prize to which in this country of necessity only a very few at present attain. Thus far the success of the three or four men who have received, approximately, this training is so convincing that the very best graduates of our own and other schools are eager for the opportunity to be tested as to their fitness to rise to the position; and I know from applications which have been made to me this year that men of the desired quality would gladly serve ten years on the surgical staff in order to obtain the experience which the house surgeonship and the training leading to it affords. The number of years which an interne who has become house surgeon is expected to serve with us is not and never has been prescribed.

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[13] W. H. Welch, Some of the Advantages of the Union of Medical School and University. New Englander and Yale Review, Sept., 1888.

Higher Medical Education and the Need of its Endowment. Medical News, July 21, 1894.

[14] The surgical staff consists of nine men, eight internes and one externe. The externe is an assistant in surgical pathology, he attends operations whenever it seems desirable in order to do with a clearer understanding the pathological work, to take charge of and describe[15] the pathological material obtained at operations and to keep in touch, for his own benefit, as well as for the sake of the surgical department, with the clinical work. Four of the internes serve for one year, only the honor men of each class at graduation being entitled to these positions; but the *permanent staff*, so-called, consists of four men, the house surgeon and three in line of preferment. Men from any part of the country, if they have had the proper training, are eligible for the permanent positions. Great care is exercised in the filling of the vacancy on the permanent staff, which occurs once in two or three years, and advancement is not guaranteed to the appointee. The House Surgeon's term of service is still optional. He receives a salary; the other assistants are not paid. The assistants are expected in addition to their ward and operating room duties, to prosecute original investigations and to keep in close touch with the work in surgical pathology, bacteriology and, so far as possible, physiology.

[15] I am sure that much of the material for surgical pathology can be correctly described only when it is perfectly fresh. It cannot be painted because in less than a minute, in a few seconds often, the appearance of a freshly cut surface is greatly changed. Only those who are well trained as macroscopic pathologists, who have naturally a discriminating eye for color, a good sense for form and some talent for expression can properly describe the fresh material. Many, if not most, of the descriptions are worthless or at best serve only as reminders to those who can distinctly recall the case. The descriptions, by two trained men, of ordinary fresh material may differ so greatly that one could not believe they pertained to the same specimen. Color photography might be employed, it seems to me, with great benefit, for recording the appearance of fresh specimens.

It will be objected that this is too long an apprenticeship, that the young surgeon will be stale, his enthusiasm gone before he has completed his arduous term of service. These positions are not for those who so soon weary of the study of their profession, and it is a fact that the zeal and industry of these young assistants seem to increase as they advance in years and as their knowledge and responsibilities become greater. Nowhere certainly can a surgeon in a given period acquire so much, mature so rapidly, as in a hospital with an active and properly-conducted service. The time devoted to the training in surgery of those who hope to be teachers should not be curtailed, but young men contemplating the study of surgery should as early in life as possible seek to acquire knowledge of the subjects fundamental to the study of their profession.

It was our intention originally to adopt as closely as feasible the German plan, which, in the main, is the same for all the principal clinics of the German universities. The house surgeon, or first assistant, as he is called in Germany, is selected, after several years of service, from a number of well-tried assistants. There is no regular advancement from the bottom to the top of the staff of resident assistants. Only a small proportion of these venture to entertain the hope of becoming first assistant. Occasionally an assistant from another clinic may immediately, or almost at once after transfer, succeed to this position over the heads of those who have served many years. This admirable system, which undoubtedly has its disadvantages, is possible only in a country where like conditions prevail and a close affiliation exists between the universities or where some great inducement exists for the making of assistants of the highest possible order. The professor of surgery, or the surgical chief, desires to secure as his first assistant or chief of staff a man of great promise, not only because of the obvious immediate advantage to the clinic, but because such an assistant is likely to have tendered him, ultimately, the chair of surgery in some smaller university. It is a matter of great satisfaction and pride to a professor of surgery to have supplied from his staff one or more university chairs. So, too, it is a great disappointment and sometimes a keen sorrow to the professor of surgery when his scholarly, highly-trained and devoted first assistant after a service with him of eight or nine years is compelled to resign himself to an instructorship, to content himself with the title "Privat-Docent." This occurs often, in fact is usually the case, because there are so many more retiring first assistants than there are vacant chairs of surgery in the twenty German universities. Whenever, consequently, there occurs by the death or voluntary retirement of a professor of surgery, a vacancy in a university, there are possibly twenty first assistants and perhaps as many Privat-Docents hoping for promotion, not necessarily to this particular university, for the vacancy, unless it is in one of the smallest universities, is usually filled by the professor in a still smaller one.

What are the inducements which make it worth while for the young men in Germany to devote so many years to preparation for the practice of surgery, what the careers to which they aspire, and what manner of men are they who furnish by their example and by their achievements the great stimulus?

Not only the first assistants but all the members of the surgical staff of one of the great university clinics in Germany enjoy almost ideal facilities for learning surgery and for prosecuting researches. The amount of clinical material is great. The operative work begins early in the morning and often does not cease till late in the afternoon. The out-patient department is controlled by the chief surgeon and is conducted by his assistants; a patient when discharged is consequently not referred to some dispensary or other and lost sight of. The pathological material obtained at operation is carefully worked up in the special laboratories for surgery and, if need be, is preserved in the museum, which should always be an important feature of the surgical department of a university. Every facility and the greatest encouragement is given each member of the staff to do work of research.

Although during the eight to twelve years of hospital service as assistant in some large university clinic he has laid the foundation of his reputation, the real life work of a German surgeon begins when he is invited to fill a professorial chair. He now longs to prove himself worthy of the new position, he has the incentive to inspire others to achieve, he measures himself by a new standard, and there is born in him the desire to rise higher, to sow the seed which will produce a bloom worthy of the greatest universities, possibly even of Berlin. In European countries no effort, no amount of time, few sacrifices would be considered too great if thereby the chair of surgery in a university might be secured. In Germany the prestige of the position is something that we in the United States who have not lived abroad cannot truly comprehend. In each university the chair has its imperishable traditions, its long line of famous surgeons, whose names are cherished and revered for their services to science, to their universities, to their country and to their fellows. In the nineteenth century, to mention only some of those who have passed to the majority, in the University of Berlin, were v. Graefe, Dieffenbach, v. Langenbeck; in Vienna, Vincenz v. Kern, Billroth, Albert; in Heidelberg, v. Chelius, Carl

Otto Weber,[16] Gustav Simon; in my student days there were in Leipzig, Thiersch; in Halle, v. Volkmann; in Bonn, Busch; in Tübingen, Victor v. Bruns; in Munich, v. Nussbaum; in Strassburg, Lücke; men of great renown, every one. To enroll one's name with such as these, to inherit something of their skill, their knowledge, their zeal, their honor, their sense of duty, is not this worth while? The professor of surgery in Germany is usually a man of great influence and power. His affiliations, his responsibilities, his knowledge of surgery and the allied sciences, and often of art, of music, of literature and of the world's affairs, produce a type of man which his country may well contemplate with pride.

America, too, in spite of discouraging circumstances, has produced great surgeons, but it is to be deplored that here conditions prevail which hitherto have not encouraged, if they have not actually prohibited, such special development as I have outlined. I have known professorial chairs in one of the principal medical schools of this country to go actually a-begging—a-begging, of course, only of men who would adorn the position. Recently I asked a prominent surgeon, to whom a chair in one of our chief universities had been offered, why he had not accepted it. He replied that his practice was a large and lucrative one and that he had neither the time nor the inclination to prepare and deliver one hundred lectures, more or less, a year. Young men are naturally only too glad and eager to secure a professorship which would insure a good living and a certain distinction, but older men who are already well known and with an assured income have no inclination to undertake teaching of a prescribed kind for which they are not trained and for which the rewards are not in their opinion proportionate to the labor. Even to those who have held the chairs of surgery for years the work sometimes becomes so irksome that they seek to abandon it as soon as directly or indirectly it ceases to yield a sufficient return.

The faults of our system of educating surgeons begin almost at the bottom and continue to the very top. I am considering only the training of the best men, those who aspire to the higher career in surgery. On graduation they become hospital internes, but their term in the hospital is only one and a half, occasionally two years, only a little longer than the term of hospital service required in Germany of every applicant for the medical degree and not so long, on the average, as that required of each medical graduate of the University of Tokio. The interne suffers not only from inexperience, but also from over-experience. He has in his short term of service responsibilities which are too great for him; he becomes accustomed to act without preparation, and he acquires a confidence in himself and a self-complacency which may be useful in time of emergency, but which tend to blind him to his inadequacy and to warp his career. A surgeon should find his greatest stimulus and support in his assistants with whom he spends or should spend many hours a day; but this is only possible when they have had opportunities for sufficient development.

Think of the labor of breaking in two new house surgeons each year and of the incompleteness of their work. "I thought I had instructed you to examine the vocal chords after every goitre operation," complains the attending surgeon; "No, it must have been my predecessor or some other house surgeon whom you so enjoined," replies the interne. It is a grave mistake, it is a shame to check suddenly the advance of these superior young men who are tense with enthusiasm, who rejoice in the work to which they hope to be able to dedicate their lives. It is from these men, we must not forget, that our teachers of surgery are made.

But much as the interne suffers from the brevity of his hospital experience, the hospital suffers more and the surgeon most. Every important hospital should have on its resident staff of surgeons at least one who is well able to deal not only with any emergency that may arise and to perform any operation known to surgery, but also to recognize the gross appearances of all the ordinary pathological tissues and lesions.[17] But the interne leaves the hospital unequipped; eventually, it may be, he secures the position of attending surgeon to some hospital and then he is expected to teach others to perform operations which he himself has not learned to do, and to pronounce at the operating table upon conditions with which he is not familiar and which possibly he has never seen nor heard of.

We need a system, and we shall surely have it, which will produce not only surgeons but surgeons of the highest type, men who will stimulate the first youths of our country to study surgery and to devote their energies and their lives to raising the standard of surgical science. Reforms, the need of which must be apparent to every teacher of surgery in this country, must come on the side both of the hospital and of the university, and it is natural to look to our newer institutions, unhampered by traditions and provided with adequate endowment, for the inception of such reforms. It is eminently desirable, if not absolutely essential, that the medical school should control a hospital of its own. There should be such an organization of the hospital staff as I have indicated, providing the requisite opportunities for the prolonged and thorough training of those preparing for the higher careers in medicine and surgery, and permitting the establishment of close and mutually stimulating relations between chief and assistants.

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[16] Weber. It is interesting to note that Weber, professor of pathological anatomy at Bonn, at the instigation of Helmholtz, was called (1865) after long deliberation to succeed Joseph von Chelius in Heidelberg. Much astonishment was naturally expressed that a pathologist should be invited to take a surgical chair, but the choice proved a most happy one, and although Weber lived to teach surgery only five semesters, he left in Heidelberg ineffaceable impressions of his great activity and learning.

In the days when operations the world over were few and far between, and when little was known of surgical pathology, it was natural and reasonable that particular stress should be laid upon a careful training in anatomy in preparation for the practice of surgery; but now when time is so short and the art of surgery so long and the operative material so abundant, the prospective surgeon's work in anatomy should be very much curtailed to give time for a very thorough training in pathology and also in physiology. The more definite the knowledge of a subject becomes, the more easily it is acquired. The surgeon should quickly master the anatomy which he requires, and gross pathology will soon be for him an easily explored field; he already looks to physiology for his particular field of research. The value to the surgeon of patient dissection of many injected and hardened cadavers is very much overestimated. The general topography of a part can be quickly and sufficiently recalled by reference to an illustration; it is a knowledge of the fasciae that the surgeon who wishes to perform an operation deftly and neatly requires, and this can be acquired only by rapid dissection of perfectly fresh material, or better still, of course, by frequent repetition of the particular operation. A hundred dissections of the embalmed neck would not shed much light upon the operations for the removal of goitre nor even of the ganglia of the sympathetic. I am speaking from the standpoint not of the student, but of him who wishes to operate artistically.

[17] The internes should be encouraged and afforded every facility for the prosecution of work in research.

The professors of medicine and surgery occupy a peculiar position. They are teachers in the universities and at the same time teachers in the technical schools, the hospitals, which in this country are in only one or two instances, unfortunately, under the control of the university. As university instructors it is still a question just how much of the technical they shall teach, and as workers in the technical school, the hospital and in private practice, how much time they shall devote to laboratory investigation. It is doubtful if an ideal adjustment, if there were such a thing, could always be preserved, because in one individual there reigns a passion for laboratory pursuits, in another the love of the practical and the rewards which practice may bring. Barker has recently, in his memorable address,[18] mooted this subject. Emphasizing the evils of the proprietary school and the inadequateness of what he designates as the "pseudo-university school," he proposes the name "semi-university school" for the "six or eight best medical schools in the United States," for the reason that only the subjects of the first two years are taught by men (university professors) "who do not engage in the private practice of medicine" and "who give their whole time and energies to the teaching and investigation of the sciences which they represent." It is to be noted that the true "university medical school," in the sense in which this designation is used by Barker, exists nowhere and probably never has existed.

The professors who teach in the departments of the last two years "are either not paid at all or are paid small sums, almost always less than the remuneration which pertains to a university chair, and almost always too little to provide the professor with a living income." "It is obvious," Barker continues, "that if those who teach the clinical subjects have to make their living from private practice, they will be compelled to direct their activities so as not to interfere with that practice." And further, he says, "I should like to see what the result would be if men with these capacities were bred to university careers, were placed in charge of hospitals especially constructed and endowed for university purposes and were sufficiently paid to permit them to give up private practice entirely and to devote their whole time and strength to teaching and investigating in such hospitals." Time permits only the very briefest consideration of this proposition, with which I am in the fullest sympathy, and which for a long time, perhaps for twenty years or more, I have seriously debated. Certain objections may nevertheless, I believe, with great propriety be urged against prohibiting the acceptance of fees by professors of surgery in universities.

1. To be an impressive teacher of surgery, to attract important cases in large numbers, to exert an influence far and wide as a surgeon, to know his subject thoroughly, the surgeon must operate every day and always. A very considerable part of the surgeon's time must be spent in the operating room; more and more, it would seem, as time advances, for the number and variety of operations which a general surgeon performs each year is prodigiously increasing.[19]

2. With a fixed salary the surgeon may devote himself to the work of his choice, whatever that may be. If his tendencies are in the direction of research, he will neglect his operative work; if he is a natural operator, he will chafe under the restrictions which prohibit the acceptance of fees so easily within his reach.

I know of one or two men to-day occupying important chairs of surgery in Germany, to whom operating is less agreeable than teaching, and whose clinics, in consequence, suffer greatly from want of surgical material. Billroth had comparatively and actually little operating to do when in the days of sepsis he was most earnestly engaged in his microscopical studies and laboratory pursuits; and Thiersch, although one of the greatest names in surgery, was not a great operator and had small operative material even for his day.

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[18] Medicine and the Universities. An address delivered before the Western Alumni of the Johns Hopkins University, at the meeting in Chicago, Feb., 1902. American Medicine, July 26, 1902.

[19] Professor von Mikulicz writes me from Breslau "When I was a student in Vienna there were days, particularly in winter, when not a single operation occurred in the University clinic, so scarce was the operative material. To-day the number of cases for operation is so great in the large German clinics that even when operations are conducted simultaneously on two tables we find that three or more hours of intense work is required almost every day." Through the kindness of friends in Boston and New York I am able to append the reports which testify to the great increase in the number of operations performed in a year in the Massachusetts General, the Boston City, the Roosevelt and the New York Hospitals. The statistics furnished by the venerable Massachusetts General Hospital are particularly instructive. In the entire decennium prior to the discovery of anæsthesia only 385 operations were performed in the hospital, an average of 38.5 operations a year. In the first decade subsequent to the employment of ether 1893 operations were performed, an average of 189 per year. In the decade preceding Lister's visit (1876) to this country, from 1868 to 1878, 7696 operations were performed. In the next decade only 10,119 operations were performed in this hospital; but from 1894 to 1904, 24,270 were performed; and in the year 1903, over three thousand operations were performed in the Massachusetts General Hospital.

The other hospitals mentioned show an increase in similar proportions. It may surprise some that the decade following the introduction of antiseptic surgery, from 1878 to 1888, should show such a slight increase. This may be taken as an indication of what is true, viz., that the majority of the operations which are done to-day were not only not attempted, but were not known fifteen years ago. Indeed many of them were unthinkable before the introduction of antiseptic surgery.

Massachusetts General Hospital.

Number of operations performed in decade previous to discovery of ether 385.
Number of operations performed in decade subsequent to discovery of ether 1893.
Number of operations performed in decade previous to use of antiseptics in this country (1878) 7696.
Number of operations performed in decade subsequent to use of antiseptics 10,119.
Number of operations performed during last ten years (1894-1904) 24,270.
Number of operations performed during year 1903 3109.

Boston City Hospital.

In 1878 316 operations were performed.
From 1878 to 1887, inclusive, 5882 operations were performed.
From 1893 to 1902, inclusive, 16,269 operations were performed.
In 1902 1923 operations were performed.

Roosevelt Hospital, New York.

In 1878 132 operations were performed.
From 1878 to 1887, inclusive, 4060 operations were performed.
From 1894 to 1903, inclusive, 18,181 operations were performed.
In 1903 2719 operations were performed.
Operations in the Gynæcological division are included.

New York Hospital.

In 1878 142 operations were performed.
From 1878 to 1887, inclusive, 2706 operations were performed.
From 1894 to 1903, inclusive, 13,002 operations were performed.
In 1903 1680 operations were performed.

3. An able and successful surgeon probably would not for the sake of fame merely and the usual professor's or any feasible salary be content to operate so constantly and to incur the anxieties attendant upon a large surgical practice. Indeed, he probably could not relinquish all fees if he would, for the exigencies of his family and his tastes would prohibit his doing so. Young and comparatively untried men could, of course, be induced to take the position, and some of these would undoubtedly regret the compact.

4. Barker proposes, if necessary, to give the professors of the practical branches (technical professors we may call them) a larger salary than the others; but this would at once place the purely scientific men in an awkward position; it would pave the way for discontent among the chemists and physicists and others, who might with propriety claim that their salaries should be increased because they, too, might make a fortune if they were allowed to turn their ideas or discoveries to commercial account. As a matter of fact professors of chemistry and physics accept fees and all professors are at liberty to do so.

5. After all, the hospital, the operating room and the wards should be laboratories, laboratories of the highest order, and we know from experience that where this conception prevails not only is the cause of higher education and of medical science best served, but also the welfare of the patient is best promoted. It remains with the teachers of medicine and surgery to make them so. The surgeon and the physician should be equipped and should be expected to carry on work of research; they hold positions which should make them fertile in suggesting lines of investigation to their assistants and associates; they should not only be productive themselves, but should serve as a constant stimulus to others.

I should like to see the plan which Dr. Barker advocates carried out to the letter, and if it should succeed no one would rejoice more than I. But I would not advocate giving the surgeon or physician a larger salary than the others. The salaries of all must eventually be increased at least two or three-fold. There is, however, a compromise which even at present is altogether feasible. Let the surgeon be permitted to accept remuneration for services to certain patients operated upon in the hospital which the university provides or controls. His consultations and operations should all take place at the hospital. He might under only very exceptional circumstances be permitted to visit a patient in his town or State. Under special circumstances he might well be permitted to visit a patient in another State, if it were impossible for that patient to come to him. Private patients in a hospital need consume little or no more of the chief surgeon's time than the patients in the public wards.

While it has been my main purpose in this address to call attention to certain defects in the existing methods of medical education, especially in the opportunities for the advanced training of surgeons in this country, I would not be understood to minimize or to decry the great achievements of American surgery. Courage, ingenuity, dexterity, resourcefulness are such prominent characteristics of our countrymen that it would have been surprising if from the labors of her many earnest and devoted teachers and practitioners there had not resulted contributions to the science and art of surgery which have carried the fame of American surgery throughout the civilized world. The names of your own Nathan Smith and Jonathan Knight will always be treasured not only by this university, but wherever the history of surgery is cultivated. There is barely time for even the briefest reference to the recent contributions of America's surgeons to their art and science, but I should do my countrymen scant justice did I fail to emphasize the importance of at least one monumental contribution, which, I believe, redounds more to the glory of American surgery than any achievement of the past. It is hardly possible to overestimate the value of the modern work on the subject of appendicitis nor to attribute to it too great a share in stimulating and clearing the way for the great strides made in the entire field of abdominal surgery in the past twelve or fourteen years. It is convincing testimony to the advanced character of this epochal work that continental surgeons were for several years unable fully to comprehend and accept the teachings of their co-workers in the new country. As operators some of our surgeons are not surpassed by any I have seen; there are, I believe, few operations in surgery which cannot be performed as well in this country as anywhere in the world, and not a few operations are best performed by the surgeons of America.

A loyal son of Yale, I have rejoiced in the increasing prosperity of the Medical Department of Yale University during these recent years. Especially gratifying have been the manifestations of interest on the part of the University in the advancement of this Department and in general in the cause of higher medical education. I may be permitted to express my appreciation, and I believe I may add that of all concerned with these important problems, of President Hadley's valuable contributions to the discussion of this pressing topic.

It need hardly be said that the Yale Medical Department is hampered by inadequate resources. I am confident that during the past year no gift to the University has been more usefully and worthily bestowed than Mrs. Farnam's generous bequest to the Medical Department. With still larger additions to its endowment there is every reason to believe that the Yale Medical School will maintain a prominent position in the forward movement of medical education and research, and be one of the chief ornaments of this great university, receiving and conferring the stimulus of lofty ideals, of large achievements, of high renown.

NOTES SUGGESTED BY THE FRANKLIN-HEBERDEN PAMPHLET OF 1759.[1]

By Henry K. Cushing, M. D.,

Of Cleveland, Ohio.

In May, 1903, there was a sale of a large collection of most interesting documents, the so-called "Proud papers," at the book auction rooms of Davis & Harvey, Philadelphia. These had been preserved from early days by a line of eminent and far-seeing men, all Philadelphians but one, as materials for a history of their Province, and from these Robert Proud arranged and published "The History of Pennsylvania in North America."[2]

Since Proud's day this notable collection has come down, from generation to generation, in the line of a distinguished Philadelphian[3] of Colonial and Revolutionary days, intrusted to him for safe keeping, and as tradition rumors, in view of aid rendered in the straitened days of the publication of the History; and in this descent the collection has grown by valuable additions of early Americana.

From this sale the scribe of these notes secured the old pamphlet which has instigated them. In state and condition it is as perfect as when it left the press, and has gained that mellow hue time alone can tint.

It bears this title:

"SOME
ACCOUNT
OF THE SUCCESS OF
INOCULATION
FOR THE
SMALL POX
IN
ENGLAND AND AMERICA,
TOGETHER WITH
PLAIN INSTRUCTIONS,
BY WHICH ANY PERSON MAY BE ENABLED TO PERFORM THE OPERATION
AND CONDUCT THE PATIENT THROUGH THE DISTEMPER.
LONDON.
PRINTED BY W. STRAHAN, M. D. CCLIX."

This pamphlet had two authors, in each of whom there is reason to be interested. "The account of the Success of Inoculation in America" bears the simple signature, B. Franklin, of Philadelphia. Franklin was in the second year of his second residence in London, not an unknown journeyman printer, but the representative of the goodly Colony of Pennsylvania, Counselor at large of the American Colonies, high in the esteem of the wise and great of two continents.

This is his preface.

"London, Feb. 16, 1759. Having been desired by my esteemed friend Dr. William Heberden, F. R. S., one of the principal physicians of this city, to communicate what account I had of the success of inoculation in Boston, New England, I some time since wrote and sent him the following paper."

This "paper" fills four pages of the printed pamphlet: the contribution of his fellow author, Dr. Heberden, the eight succeeding pages.

In the Heberden preface is this statement, "Printed at the expense of the author, to be given away in America." William Strahan, the printer, was a little later Printer to the King, Member of Parliament, the old and constant friend of Dr. Samuel Johnson, according to Boswell, and intimate business and personal friend of Benjamin Franklin of long duration.[4]

William Heberden was the best classical scholar of his day, one of the group of great London doctors, friends and intimates of their American Associate F. R. S. for Franklin as you know was a Fellow.[5]

Heberden was one of the medical friends of Dr. Johnson, who once characterized him as "Ultimum Romanorum," the last of the learned physicians.

I do not find this philanthropic waif mentioned in Henry Stevens' abounding Bibliotheca Americana, or in Sparks', Bigelow's, Parton's or other biographies of Franklin at my command. A note but recently received from the Librarian at the British Museum reports that there is no copy in its library, neither is there one in the Congressional Library, or in that of the noted Boston Medical Library Association.

The Boston Public Library has a copy, as I learn from its catalogue of 1883, of books relating to Franklin in its possession. A note in this catalogue relates that in the Mass. Hist. Soc. Collections,[6] a reproduction of this pamphlet was published in 1816, through the instigation of Dr. John Farmer.

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[1] Read before the Johns Hopkins Hospital Historical Club, May 23, 1904.

[2] Printed in Philadelphia, vol. i appeared in 1797; vol. ii in 1798.

[3] Philip Syng Physick, M. D. "Mr. Physick placed his son when eleven years of age in the Academy belonging to the Society of Friends in South Fourth St. under the tuition of Robert Proud."

Memoir of the life and character of Philip Syng Physick, M. D. By I. Randolph, M. D., 1839.

[4] Franklin's letter to Strahan from Philadelphia in 1746.

[5] He was made F. R. S. April 29, 1756. "As an additional mark of honor, by vote of the Council, he was relieved from the payment of all fees; and it was ordered that he was to receive the Transactions without cost."—Franklin Cronology.

Three years before, 1753, the R. S. had awarded him the Copley Gold Medal for his electrical discoveries.

[6] Vol. ii, p. 7.

This is his note to the editor.

> "AMHERST, N. H., Oct., 1816.
>
> REV. SIR.—At this time I send you an account of the Success of Inoculation in Boston, written by Dr. Franklin to Dr. Heberden, in London. I have transcribed it from a pamphlet printed in London in 1759. With much respect
>
> Your obedient servant
>
> JOHN FARMER.
>
> REV. DR. HOLMES."

The Rev. Dr. Holmes, of the Mass. Hist. Soc., was the Rev. Abiel Holmes, long minister of the First Church in Cambridge, author of the History of America from the discovery in 1492 to 1806, and father of Oliver Wendell Holmes. Thus 57 years after the issue of the pamphlet from the press in London, and eighty-eight years ago, a copy was sent for publication in Franklin's natal town as a rarity and subject of historical interest.

Paul Leicester Ford, in his useful Bibliography of Benjamin Franklin, quotes the pamphlet but ascribes the "Instructions" to Dr. Archer, instead of Dr. Heberden. Dr. Archer was physician to the London Small pox hospital at the time, and was mentioned by name in the "Instructions," from whence probably arose Ford's misconception.

Dr. Packard[7] reproduces Franklin's portion of the pamphlet with this approval . . . "Which is of such interest and presents such a common sense view of the status of the practice of inoculation at that time that I reprint it in its entirety."

The Surgeon General's Library, Washington, that of the Academy of Medicine, New York, of the Mass. Hist. Soc., Boston, and of the College of Physicians, Philadelphia, are fortunate owners each of a copy, making, with the subject of these notes six, and all I have been able to locate.

How many copies of this brochure were printed by Dr. Heberden I do not know, but presumably but a few hundred, and these, like New England Primers, and Poor Richard's Almanacs, published for years by tens of thousands, have few known survivors.

Franklin does state that Heberden "printed a very large impression of them," but 500 would seem to me a large impression for those days.

Dr. Packard informs me that he has 5000 in mind as the true number, but cannot recall his authority.

One would like to know how they were disseminated, of their reception and their influence. Primarily would they not have come into the hands of preachers, many of whom were practitioners as well, of doctors, of town clerks, usually men of more attainments than most of their fellows, and of postmasters, for Franklin had now been Deputy Post-Master General of the Continental Colonies for six years?

From Proud's History I take this instance of the then ever-present imminence of small pox, and of the acquired equanimity with which it was endured as one of the accompaniments of life sooner or later to be reckoned with.

> "William Penn had for a considerable time past been making preparation for his voyage to America, which being at last accomplished in the sixth month of the year 1682, accompanied by a number of his friends, he went on board the ship Welcome, of 300 tons, Robert Greenway, Commander, and on the 30th of the same month (it was August) he writ from the Downs a valedictory epistle.
>
> "The number of passengers on the ship was about 100, mostly Quakers from Sussex, the proprietaire's place of abode. In this passage many of them were taken with the small pox, and about 30 of the number died. In this trying situation the acceptable company of William Penn is said to have been of singular advantage to them, and his kind advice and assistance during the passage, so that in the main they had a prosperous voyage."

Estimating the crew of such a ship at 20 men (a large estimate probably) making with the passengers 120 souls all told, the mortality of 30 would have been one in four of all on board.

But the passengers fared even worse for one-third of them died on the eight weeks' voyage, as the Welcome did not get within the Capes of the Delaware until the 24th of October.[8]

One of the Welcome's passengers was Dr. Griffith Owen, a Welsh Quaker, later one of Pennsylvania's eminent physicians.

His ministrations, however, seem not to have been thought worthy of mention beside the "acceptable company" of the great Proprietaire.

The high born and distinguished Lady Mary Wortley Montague had small pox in early life, and though she escaped pitting, yet suffered the permanent loss of her eyelashes, an unfortunate blemish to an otherwise lovely face. Her only brother, the young Lord Kingston, heir to the Kingston Dukedom, died of it.

We can appreciate the interest with which Lady Mary heard of, and made herself acquainted with, the subject of inoculation for the small pox while in her residence in Turkey.

As you know, the early history of inoculation is largely one of speculation and probability. In the early years of the 18th century intimations, through letters and reports, began to appear in Europe, that in the Levantine regions a method of inducing a mild form of small pox was practiced by the common folk.

As information developed it became known that in Hindustan, Central Asia, China, Arabia and Moslem portions of Africa the practice in somewhat varied form, had so long been followed that its early history had been lost.

As the subject became generally known and considered it was also found that in some parts of Great Britain and Europe a practice of inoculation had long been resorted to by the peasantry, usually under the name of buying the small pox, a designation also common for it in the Levant, and parts of Africa. The South of Wales, Pembrokeshire, parts of the Scottish Highlands and Islands, Auvergne and Perigord in France, and Naples and Pavia in Italy are claimed, with seeming good reason, as seats of this practice.[9] The designation was due to the custom of offering gifts or compensation to the individual who was to furnish the desired variolous matter.

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[7] History of Medicine in the United States, 1901, p. 108.

[8] Encyclopedia Britannica.

It is fairly supposable that in divers countries and localities, experience through centuries with small pox epidemics, had revealed to occasional acute observers here and there, that persons suffering the ill received through abrasions or wounds on the hands had a milder form, than when it was taken in the ordinary way of infection. Inducing the disease in imitation, in hope of securing a milder type, would seem a natural sequence of consideration and action. It was the custom of some of the eastern peoples to inoculate between the thumb and forefinger, which strongly suggests that they were simply copying the hint indicated by accidental infection through the hands.

In all those regions of Asia and Africa where sowing, engrafting or inoculating the small pox was practiced, the camel was domesticated and the milk generally used.

Dr. Jenner[10] refers to the traditionary accounts, handed down by the Arabian physicians, that the small pox was originally derived from the camel. Casual infection through the hands, in grooming or milking these beasts, may have given the original suggestion of perpetuating a milder type by artificial transmission, as a similar condition in Gloucestershire dairies put Jenner on his long series of investigations on the cow pox.

The communications of Europeans, sojourning in the Levant, concerning this procedure made little appreciable impress on the convictions of their home peoples. Of these communications the historic ones are those of Dr. Emanuelle Timoni Patavino, a Greek physician, graduate of Pavia and Oxford, resident in Constantinople early in the 18th century, who in 1713 wrote a relation of the subject to a London physician, Dr. John Woodward, who communicated it to the Royal Society; and that of Dr. Jacobus Pylarinus, a Venetian physician, dedicated to the English Consul at Smyrna, which reported the Byzantine method of inoculating. The two appeared simultaneously in Vol. XXIX of the Royal Transactions, in 1717.[11] (See Appendix, II, page 284.)

Lady Mary Wortley Montague courageously determined not only to adopt this oriental custom of the common people, but to impart to friends at home the knowledge she had gained.

To her influence and example, according to popular impression, "we are indebted for its introduction and adoption in England, and for its consequent diffusion through Christendom."[12] Lady Mary's first letter on the topic was to her friend Mary Chiswell, from Adrianople, April 1, 1717, O. S. She wrote: "The Small pox so fatal and general amongst us is here entirely harmless by the invention of ingrafting, which is the term they give it. There is a set of old women who make it their business to perform the operation every autumn when the heat is abated.[13]

"People send to one another to know if any of their family has a mind to have the small pox; they make parties for the purpose; and when they are met (commonly 15 or 16 together) the old woman comes with a nut shell of the matter of the best small pox."[14]

Her little son Edward, three years old, was soon after inoculated under the supervision of Mr. Maitland, surgeon to the British Ambassador, her husband, at the Ottoman Court.[15]

She inserted it so roughly and clumsily in the arm of the child that Mr. Maitland completed the operation in the other arm.

The Montague's returned to England in October, 1718, but only in April, 1721, two and one-half years later, was the daughter, born in Turkey, (four months old when the brother was inoculated) inoculated in London, also by Mr. Maitland. This was the first recorded example in Europe, outside of European Turkey.

The Princess Caroline, of Wales, having lost a daughter by small pox, and anxious to preserve her other children, though an intimate friend of Lady Mary's, was not fully at ease as to the safety of the operation.

The King, at her solicitation, pardoned six criminals who were willing to undergo the ordeal on those terms.[16]

They were inoculated at Newgate by Mr. Maitland, August 9th, 1721, four months later than Lady Mary's daughter. In further trial two groups of Charity children, one of six and one of five, were also successfully operated upon in the spring of 1722.

The Princess now influenced Sir Hans Sloane, the Court physician, to wait upon the King (George I), for his assent. His Majesty concurring, the Princesses Anne and Caroline were, on the 19th of April, 1722, inoculated, under the direction of Sir Hans, a year after the operation on Lady Mary's daughter. But 845 persons in all England, were inoculated in the eight years following the example given by Lady Mary, and of these 17 died, nearly one in fifty. Hence we may judge of the slow and struggling development of the practice, and that the operators had not yet attained to the supposedly safer ways of the oriental performers.

Even the learned Heberden, 30 years later, was in grave fault in his pamphlet directions.

He says "every one would desire to be inoculated from as healthy a person as he could, and then strangely adds, though I believe the health of the person from whom the matter in taken is of very little consequence; it is of none whether he had a good or bad sort, whether he had few or many." This contrasts badly with the old woman "who comes with a nut shell of the matter of the best small pox."

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[9] Crookshank, Monroe on Small Pox, 1818.

[10] Baron's Life of Jenner, vol. i, p. 522.

[11] "Illustris, Preclaris atque Erudissimo Viro Wilhelmus Scherard, Dignissimo pro inclyta Natione Britannica Nunc Smirnis Consulo."

[12] Baron's Life of Edward Jenner, vol. i, p. 230.

[13] An old Greek woman, many years in the habit of engrafting, was employed to procure variolous matter from a suitable subject.

[14] Always taken from a child.

[15] Crookshank on Vaccination.

[16] It succeeded happily upon five of them, the sixth, it was found, had already had small pox.

By 1740 the practice had become nearly obsolete in England, but favorable accounts coming from the West Indies and both Americas a new impetus was given it. The planters and other slave holding folk of the new world had largely adopted it to preserve their costly slave property from sickness, blindness and death from the scourge, so virulent with the dark skinned races.

The Carmelites, and Friars of other orders in Portuguese and Spanish America, had introduced the practice, with great advantage, in the Indian races.

In 1746 the small pox hospital of London was founded to extend the practice among the city poor, and to sequester them, while ill, from the people at large.

In 1754, the influential College of Physicians of London declared its full approbation of the practice, and in 1759 we have found large hearted Dr. Heberden invoking Franklin's aid, for in America, as well as in Great Britain and in much of Europe, there were broad regions where it had not been adopted.

In Franklin's account of inoculation prepared for Heberden he makes this statement:

> "Notwithstanding the now uncontroverted success it does not seem to make that progress among the common people in America which was at first expected. Scruples of conscience weigh with many, . . . and if one parent or near relation is against it the other does not choose to inoculate a child without consent of all parties, lest in case of disastrous event perpetual blame should follow."

Franklin had much reason for thorough interest in all that concerned small pox, and in inoculation, its only known alleviation, beside that consideration his ever investigating mind would have compelled.

James Parton, in his life of Franklin, says:

> "About the time Benjamin Franklin donned the apron of the prentice boy Lady Wortley Montague came home from Turkey with the secret of the inoculation for the small pox.
>
> "Cotton Mather read all about it, theory and practice, in the Transactions of the Royal Society, which he received regularly and to which he sent contributions.[17] He warmly welcomed the perilous invention, as did his venerable father, Increase Mather. Through their great influence a trial of inoculation was made in 1721, and with such success, that of 285 inoculated in Massachusetts only six died.[18] Nevertheless a great clamor arose against it as there does against every valuable idea or scheme when it is first promulgated.
>
> "The witty correspondents of the Courant, James Franklin's paper, . . . led the attack upon the new remedy, . . . The apprentice meanwhile set the types, worked at the press and carried about the papers never presuming to take part in the controversy, keenly as it must have interested him."

Parton devotes some pages to the stirring occasion, which moved the town to its depths, and might have made some mention, of Dr. Zabdiel Boylston, who alone of Boston's doctors dared to test the procedure, at Mather's prompting.

With the rather meagre information from the Royal Transactions, and in face of the most violent opposition, on the 27th of June, 1721, he inoculated his only son, about 15 years of age,[19] and a middle-aged negro man and child of the family servants, with complete success. This was but two months later than the inoculation of Lady Mary's daughter in London, and there is no evidence that it could have been known in, or had the least influence in introducing the practice in New England.

Thus the communication of Timoni and Pylarini issued in the August Transactions of the Royal Society, little heeded in Great Britain, bore noble fruit in New England, through the Mathers' zest for knowledge and usefulness.[20]

Dr. Boylston, 40 years old at this time, erudite and respected, became the victim of a general spirit of malice and persecution. He was reviled, assaulted in the streets; his house mobbed and repeatedly harried. Parties patrolled the town with halters ready to hang him on the first convenient tree. For 14 days, at one time, he was obliged to remain hidden in a secluded place, unknown to any of his family but his wife, while by day and night parties entered seeking him.

Even after the rancor of the multitude had in some measure subsided he ventured to visit his patients only at night, and in disguise.

Many of his fellow physicians were of his chief contemners, abetting the lawlessness rampant in the community. Dr. William Douglass, a resolute and accomplished man, a comparatively recent comer, was foremost among these, of whom it has been recorded "that he was always positive and sometimes accurate." Though deriding the proposal of inoculation, he claimed to have furnished Cotton Mather the authorities, on inoculation behind this contention.

In a tract Douglass published in 1730 he says: "The small pox spread in Boston in 1721, and the Rev. Dr. Cotton Mather having had the use of these papers from Dr. William Douglass (i. e. the writer of these notes) surreptitiously, without the knowledge of his informer, that he might have the honor of a new fangled notion, set an undaunted operator at work." All untrue, I presume, except the undesigned compliment to the intrepid Dr. Boylston. Gov. Thomas Hutchinson,[21] last Colonial Governor of Massachusetts, relates some things of interest in this connection. "In 1721 the small pox made great havoc in Boston and neighboring towns, brought into the harbor about the middle of April by the Saltortugas fleet.[22]

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[17] Packard Hist. of Medicine in the U. S., p. 24, says: "Cotton Mather was a member of the Royal Society."

[18] These were all inoculated within a year's time, and all in the three towns, Boston, Cambridge and Roxbury. Dr. Boylston inoculated 247, Drs. Robey and Thompson 39, or one-third as many as were inoculated in all England in eight years.

[19] Age variously stated from 4 to 15.

[20] Dr. Holmes says: "Set this good hint of Cotton Mather against that letter of his to John Richards, recommending the search after witch marks, and the application of the water-ordeal, which means, throw your grandmother into the water if she has a mole on her arm; if she swims, she is a witch and must be hung; if she sinks, the Lord have mercy on her soul."—O. W. Holmes, The Med. Prof. in Mass.

[21] History of Mass.

Having been prevented spreading for near 20 years before, all born within that time, with those who had escaped it before were liable to the distemper.[23].

Inoculation was introduced upon the occasion contrary to the minds of the inhabitant in general, and not without hazard to the lives of those who promoted it from the rage of the people. Dr. C. Mather, one of the principal ministers of Boston, had observed in the Philosophical transactions, letters . . . giving a very favorable account of the operation, and recommending a trial to the physicians of the town when small pox first began to spread, but they all declined it except Dr. Boylston, who made himself very obnoxious. Many sober, pious people were struck with horror, and were of opinion that if any of his patients should die he ought to be treated as a murderer."

The aged Increase Mather (82 years) issued an address to the public in the hope of enlightening general opinion. In tone and character it was most temperate and reasonable He wrote:

> "It has been questioned whether inoculating the small pox be a lawful practice.
>
> "I incline in the affirmative because I have read that in Smyrna, Constantinople and other places thousands of lives have been saved by inoculation, and not one of thousands have miscarried by it.
>
> "This is related by wise and learned men who would not have imposed on the world a false matter.
>
> "Therefore a great regard is due to it. . . And we have an army of Africans among ourselves who have themselves been under it, and give us all the assurance which a rational mind can desire that it has been used in Africa."

Cotton Mather, too, says:

> "I was first informed of it by a Garamantee[24] servant of my own long before I knew that any European or Asiatic had the least acquaintance with it, and some years before I was enriched with the communications of the learned foreigners whose accounts I found agreeing with what I had received from my servant when he showed me the scar of the wounds made for the operation, and said that no person ever died of the small pox in his country who had the courage to use it.
>
> "I have since met with a considerable number of those Africans who all agree in one story; that in their country grandy many dy of small pox; but now since they know this way, people take juice of small pox, and cutty skin and put in a drop; then by-nby a little sicky, sicky! then few little things like small pox; and nobody dy of it; and nobody have small pox any more."[25]

May not here lie the explanation of the Mathers' putting ready faith in what, but for this long known testimony of their African servants, would have seemed but an heathen legend strongly flavored with witch-craft or diablerie.

Dr. Boylston was a zealous botanist and naturalist and corresponded with Sir Hans Sloane, President of the Royal Society, before these days of stress due to inoculation. In 1723, on the invitation of Sir Hans, Dr. Boylston went to London, where he seems to have remained two or three years. He was received by the King, Geo. I,—prepared a dissertation on inoculation, dedicated to Princess Caroline, and published by the Royal Society, of which he was made a Fellow, and was presented by the King with 1000 guineas in token of the Royal appreciation of his services and influence in the cause of inoculation.

On page 29 of the "Many Sided Franklin" is reproduced, in fac simile, the notice which appeared in the Pennsylvania Gazette, Benjamin Franklin's own paper under date of Dec. 1736, in Franklin's 30th year.

> "Understanding tis a current report that my son Francis, who died lately of the small pox, had it by inoculation; and being desired to gratify the public in that particular; inasmuch as some people are by that report . . . deterred from having that operation performed on their children, I do hereby sincerely declare that he was not inoculated but received the Distemper in the common way of infection; and I suppose the Report could only arise from its being my known opinion that Inoculation was a safe and beneficial Practice; and from my having said among my acquaintances that I intended to have my child inoculated as soon as he should have received sufficient strength from a flux with which he had long been afflicted."—B. Franklin.

Franklin afterwards wrote "I long regretted him bitterly, and still regret I had not given him the disease by Inoculation." For the remainder of his long life everything connected with small pox and inoculation must have clung closely to his remembrance and reflections. Franklin died early in 1790. The immortal Jenner had been zealously engaged for years in the elucidation of a safer and simpler remedy for the great distemper, under difficulties, discouragements and scepticism sufficient to have dazed one not of heroic mould.

In 1797 Jenner presented to the Royal Society, of which he was a Fellow, a manuscript giving the result of his researches and experiments, with the modest title of

"AN
INQUIRY
INTO
THE NATURAL HISTORY OF A
DISEASE KNOWN IN GLOUCESTERSHIRE
BY THE NAME OF THE COW-POX."[26]

The Council of the Royal Society declined to recommend it for publication, intimating that it would entail the loss of such scientific repute as he then possessed gained through previous publications in that body.[27]

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[22] Vessels salt laden from the Tortugas.

[23] According to the records of the selectmen of Boston, of 5889 who took it in the city, 884 died, about one in seven. Boston had the year before, but 11,000 inhabitants, so that more than one-half of them must have participated in the epidemic as sufferers.

[24] Garamantez, a country between the western end of the Saraha and the Atlantic coast.

[25] The Medical Profession in Massachusetts, O. W. Holmes.

[26] The manuscript, with some letters of John Hunter to Dr. Jenner, were given to Sir James Paget, in 1877, by a lady who had received them by will from her cousin, Colonel Jenner, son of Dr. Jenner. In 1879 Sir James Paget gave them to the library of the R. C. S. of London.

In June the next year, 1798, he published himself in small quarto form a pamphlet of some 70 pages, giving the matured results of his researches and experiments, with a somewhat more elaborate title than that of the manuscript declined by the Council of the Royal Society, to-wit:

"AN
INQUIRY
INTO
THE CAUSE AND EFFECTS
OF
THE VARIOLAE VACCINIAE,
A DISEASE
DISCOVERED IN SOME OF THE WESTERN COUNTIES OF ENGLAND,
PARTICULARLY
GLOUCESTERSHIRE,
AND KNOWN BY THE NAME OF
THE COW-POX.
BY EDWARD JENNER, M. D., F. R. S., ETC."

It was dedicated to his friend, C. H. Parry, M. D., at Bath.

In the succeeding year, 1799, a second edition was published, dedicated to the King.

With what interest would Franklin have welcomed the knowledge of Jenner's researches on inoculation with the cow pox, or vaccination as commonly known, if he had survived, in whole mind, to that date but eight years only after his death.

He was a Bible student, a great admirer of its impressive English, and well acquainted with its contents. If the opportunity had been of his forecasting the result of Jenner's devoted work, might he not have recalled Numbers xvi, 48, where it is recorded of Aaron, "and he stood between the dead and the living and the plague was staid."

APPENDIX I.

BENJAMIN FRANKLIN'S LETTER.

SOME
ACCOUNT
OF THE SUCCESS OF
INOCULATION
FOR THE
SMALL-POX
IN
ENGLAND AND AMERICA.
TOGETHER WITH
PLAIN INSTRUCTIONS,
BY WHICH ANY PERSON MAY BE ENABLED TO PERFORM THE
OPERATION, AND CONDUCT THE PATIENT THROUGH THE DISTEMPER.

LONDON:
PRINTED BY W. STRAHAN, M. DCC. LIX.

London, Feb. 16, 1759.

Having been desired by my greatly esteemed friend, Dr. William Heberden, F. R. S., one of the principal Physicians of this city, to communicate what account I had of the success of Inoculation in Boston, New-England, I some time since wrote and sent to him the following paper, viz.:

About 1753 or 54, the small-pox made its appearance in Boston, New-England. It had not spread in the town for many years before, so that there were a great number of the inhabitants to have it. At first, endeavors were used to prevent its spreading, by removing the sick, or guarding the houses in which they were; and with the same view Inoculation was forbidden; but when it was found that these endeavors were fruitless, the distemper breaking out in different quarters of the town, and increasing, Inoculation was then permitted.

Upon this, all that inclined to Inoculation for themselves or families hurried into it precipitately, fearing the infection might otherwise be taken in the common way; the numbers inoculated in every neighborhood spread the infection likewise more speedily among those who did not chuse Inoculation; so that in a few months the distemper went thro' the town, and was extinct; and the trade of the town suffered only a short interruption, compar'd with what had been usual in former times, the country people during the seasons of that sickness fearing all intercourse with the town.

As the practice of Inoculation always divided people into parties, some contending warmly for it, and others as strongly against it; the latter asserting that the advantages pretended were imaginary, and that the Surgeons, from views of interest, conceel'd or diminish'd the true number of deaths occasion'd by Inoculation, and magnify'd the number of those who died of the Small-pox in the common way: It was resolved by the Magistrates of the town, to cause a strict and impartial enquiry to be made by the Constables of each ward, who were to give in their returns upon oath; and that the enquiry might be made more strictly and impartially, some of the partisans for and against the practice were join'd as assistants to the officers, and accompany'd them in their progress through the wards from house to house. Their several returns being received, and summed up together, the numbers turn'd out as follows,

Had the Small-pox in the common way.		Of these died.		Received the distemper by Inoculation		Of these died.	
Whites.	Blacks.	Whites.	Blacks.	Whites.	Blacks.	Whites.	Blacks.
5059	485	452	62	1974	139	23	7

It appeared by this account that the deaths of persons inoculated, were more in proportion at this time than had been formerly observed, being something more than one in a hundred. The favourers of Inoculation however would not allow that this was owing to any error in the former accounts, but rather to the Inoculating at this time many unfit subjects, partly through the impatience of people who would not wait the necessary preparation, lest they should take it in the common way; and partly from the importunity of parents prevailing with the Surgeons against their judgment and advice to inoculate weak children, labouring under other disorders; because the parents could not immediately remove them out of the way of the distemper, and thought they would at least stand a better chance by being inoculated than in taking the infection as they would probably do, in the common way.

The Surgeons and Physicians were also suddenly oppressed with the great hurry of business, which so hasty and general an Inoculation and spreading of the distemper in the common way must occasion, and probably could not so particularly attend to the circumstances of the patients offered for Inoculation.

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[27] The original manuscript is now in the Library of the Royal College of Surgeons, London, Crookshank, Vol. I, p. viii.

Inoculation was first practiced by Dr. Boylstone in 1720.[28] It was not used before in any part of America, and not in Philadelphia till 1730. Some years since, an enquiry was made in Philadelphia of the several Surgeons and Physicians who had practis'd Inoculation, what numbers had been by each inoculated, and what was the success. The result of this enquiry was that upwards of 800 (I forget the exact number) had been inoculated at different times, and that only four of them had died. If this account was true, as I believe it was, the reason of greater success then than had been found in Boston, where the general loss by Inoculation used to be estimated at about one in 100, may probably be from this circumstance; that in Boston they always keep the distemper out as long as they can, so that when it comes, it finds a greater number of adult subjects than in Philadelphia, where since 1730 it has gone through the town once in four or five years, so that the greatest number of subjects for Inoculation must be under that age.

Notwithstanding the now uncontroverted success of Inoculation it does not seem to make that progress among the common people in America, which at first was expected. Scruples of conscience weigh with many concerning the lawfulness of the practice: And if one parent or near relation is against it, the other does not chuse to inoculate a child without free consent of all parties, lest in case of a disastrous event, perpetual blame should follow.

These scruples a sensible Clergy may in time remove. The expense of having the operation performed by a Surgeon weighs with others, for that has been pretty high in some parts of America; and when a common tradesman or artificer has a number in his family to have the distemper, it amounts to more money than he can well spare. Many of these, rather than own the true motive for declining Inoculation, join with the scrupulous in the cry against it, and influence others. A small pamphlet wrote in plain language by some skilful Physician, and publish'd, directing what preparations of the body should be used before the Inoculation of children, what precautions to avoid giving the infection at the same time in the common way, and how the operation is to be performed, the incisions dressed, the patient treated, and on the appearance of what symptoms a Physician is to be called, &c., might, by encouraging parents to inoculate their own children, be a means of removing that objection of the expense, render the practice much more general, and thereby save the lives of thousands.

The Doctor, after perusing and considering the above, humanely took the trouble (tho' his extensive practice affords him scarce any time to spare) of writing the following Plain Instructions,[29] and generously at his own private expense, printed a very large impression of them, which was put into my hands to be distributed gratis in America. Not aiming at the prize which however is justly due to such disinterested benevolence, he has omitted his name; but as I thought the advice of a nameless Physician might possibly on that account be less regarded I have, without his knowledge, here divulged it. And I have prefixed to his small but valuable work these pages, containing the facts that have given rise to it; because facts generally have, as indeed they ought to have, great weight in persuading to the practice they favour. To these I may also add an account I have been favoured with by Dr. Archer, physician to the Small-pox Hospital here, viz.:

	PERSONS
There have been inoculated in this Hospital since its first institution to this day, Dec. 31, 1758	1601
Of which number died	6
Patients who had the Small-pox in the common way in this Hospital, to the same day	3856
Of which number have died	1002

By this account it appears, that in the way of inoculation there has died but one patient in 267, whereas in the common way there has died more than one in four. The mortality indeed in the latter case appears to have been greater than usual, (one in seven, when the distemper is not very favourable, being reckoned the common loss in towns by the Small-pox, all ages and ranks taken together) but these patients were mostly adults, and were received, it is said, into the Hospital after great irregularities had been committed. By the Boston account it appears, that, Whites and Blacks taken together, but about one in eleven died in the common way, and the distemper then was therefore reckoned uncommonly favourable. I have also obtained from the Foundling Hospital (where all the children admitted, that had not had the Small-pox, are inoculated at the age five years) an account to this time of the success of that practice there, which stand thus, viz.

Inoculated, boys 162, girls 176, in all	338
Of these died in Inoculation, only	2

An the death of one of these two was occasioned by a worm fever.

On the whole, if the chance was only as two to one in favour of the practice among children, would it not be sufficient to induce a tender parent to lay hold of the advantages?

But when it is so much greater, as it appears to be by these accounts (in some even as thirty to one) surely parents will no longer refuse to accept and thankfully use a discovery God in his mercy has been pleased to bless mankind with: whereby some check may now be put to the ravages that cruel disease has been accustomed to make, and the human species be again suffered to increase as it did before Small-pox made its appearance. This increase has indeed been more obstructed by that distemper than is usually imagin'd: For the loss of one in ten thereby is not merely the loss of so many persons, but the accumulated loss of all the children and children's children the deceased might have had, multiplied by successive generations.

B. Franklin,
of Philadelphia.

WILLIAM HEBERDEN'S INSTRUCTIONS.

PLAIN
INSTRUCTIONS
FOR
INOCULATION
IN THE
SMALL-POX;
BY WHICH ANY PERSON MAY BE ENABLED TO PERFORM THE OPERATION, AND CONDUCT THE PATIENT THROUGH THE DISTEMPER.

LONDON:
PRINTED AT THE EXPENCE OF THE AUTHOR, TO BE GIVEN AWAY IN AMERICA.
M. DCC. LIX.

Introduction.

Inoculation, as I am well assured, would be much more general among the English on the Continent of America and of course many lives would be saved, if all, who are desirous of being inoculated, could easily be furnished with the means of having it done.

This consideration has engaged me to draw up a few short and plain instructions, by which any person may be enabled to perform the operation in a tolerable manner and to conduct the patient through the distemper in those places where it is not easy to procure the assistance of physicians and surgeons; and this practice has so greatly the advantage over every other way of communicating the Small-pox, that it would be the better to have inoculation performed by any body, or in any manner, than to suffer this disease to come on in the common way, though assisted with all the helps which art can afford.

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[28] The year was 1721.

[29] To make them the plainer and more generally intelligible, the Doctor purposely avoided, as much as possible, the medical terms and expressions us'd by Physicians in their writings.

PLAIN
INSTRUCTIONS, &C.

OF THE SEASON OF THE YEAR PROPER FOR INOCULATION.

All seasons of the yeare are equally proper, as far as my experience goes; the bad sorts of Small-pox are not more common, or more fatal in hot or cold weather, than when the air is temperate. But as to the mild sorts, usually produced by inoculation, the extremes of weather in England are so far from bringing any danger, that they bring little or no inconvenience to the patients.

That the hottest weather is not too hot for inoculation is plain from this consideration, that it has been and is practised with success in the hottest of the English colonies in the West Indies. There is certainly this advantage attending hot weather, that it allows us to keep the doors or windows of the sick room open, whence arises such a constant renovation and purity of the air, as would, in my opinion, abundantly make amends for all the pretended inconveniences arising from heat, though they were much greater than have ever yet been supposed.

On the other hand, I know of no disadvantages attending winter which will not be sufficiently remedied by fires; and these too will help to make the air of the room constantly fresh.

If I was to make an objection against any season of the year (which I do not) it should be against the spring, though this has usually been chosen by inoculators; for it is in spring, more than in any other season, that many chronical and hereditary distempers are more particularly apt to make their appearance, and to be most troublesome.

OF THE AGE, CONSTITUTIONS, &C. OF THE PERSONS TO BE INOCULATED.

Children are very successfully inoculated at a month or six weeks old; and there is a particular advantage in their undergoing it while they are at the breast, as they make no difficulty of sucking; and the milk is the best food and physic which they can take. From the time of their being weaned to the tenth year, every year seems equally proper; only the longer it is delayed, the more danger will there be that the distemper may be catched in the common way. After the first ten years every year is, perhaps, better than the following one; though inoculation may always be practiced with great advantages over the other ways of receiving the small-pox at all ages, till we come to an age so advanced, that the consideration of the infection being perhaps less easily propagated among old people, joined with that of his having but little of life to lose, may make an old man not think it worth his while to submit to it.

It would be madness to inoculate one who was already laboring under some other acute (or violent) distemper. But as to sickly constitutions, and chronical or habitual disorders, I know none which heighten the danger of the Small-pox by having a particularly malignant influence upon it.

Many persons ill of venereal distempers, and others in the last stages of consumption, scrofulous and dropsical disorders, who have accidentally catch'd the Small-pox, have been observed to have it in the most favorable manner.

No one, therefore, ought to be discouraged from being inoculated merely on account of a weakly constitution, or because he is tainted with some hereditary or tedious distempers; unless they were so slight, or so dangerous as to make a probability that he might be cured, or would die before he would be in danger of catching the disease in the common way.

For such an one would receive as much benefit from inoculation as the healthiest person; nor, as far as I have seen, has he reason to fear more danger from it; care only should be taken to choose that time when he happens to be most free from his habitual complaints.

But though I see no reason to refuse the inoculating of such persons as I have been mentioning, yet there are others on whom no consideration whatever should tempt us to perform it, unless we can suppose an absolute certainty of their catching it in the common way; the persons I mean are breeding women.

There is a certain time in every month, during which it has been judged improper to inoculate women. This caution I find by experience to be useless; having known several inoculations at that time without any sort of inconvenience; nor is there any reason for contriving the inoculation so as that the courses shall not happen during the height of the distemper. Let them come when they will, they do no kind of harm, and seem of no consequence, and may be wholly disregarded. They are observed almost always to come on, even out of their regular course, at the eruption of the Small-pox, whenever the patient happens to be considerably full of it; I have talked with physicians who have thought this irregular appearance beneficial, but never heard of any who had reasons to think it hurtful.

OF THE PREPARATION.

Children under two years of age require no preparation; those who exceed this age, every other night for a fortnight before they are inoculated, should take four or more grains of rhubarb, or equal parts of rhubarb and jalap, so as to occasion one stool extraordinary the next day. If ever they had been used to drink any thing stronger than water, or very weak small beer, they must at this time be forbidden it; and they should eat meat only every other noon. As to their play and exercise without doors they may go on just as they used to do.

Such as are grown up may likewise be sufficiently prepared in a fortnight; during which they may be allowed to make half their dinner every day on meat; puddings, tarts, greens or roots, must make the other half. They should wholly abstain from all strong liquors, unless habit has made some absolutely necessary; and in this case they must do with as little as they can. Four such gentle purges should be taken in this time, as that each of them should occasion not above four or five motions. Bleeding is unnecessary. All great fatigue, and violent exercise should be forborn, together with all intense thinking, and application to perplexing business.

OF THE MANNER OF INOCULATING.

Every one would desire to be inoculated from as healthy a person as he could, though I believe the health of the person, from whom the matter is taken, is of very little consequence: it is of none, whether he has a good or bad sort, whether he has few or many.

The proper time for taking the matter is just before it would have dried up. In order to take it, any sort of thread must be had ready about the thickness of a common pin.

The head of one of the Small-pox may be opened with a needle, or pin, and then the thread is to be drawn along this, and other pocks, if it be necessary, till it is thoroughly wetted. The thread, thus wetted, may be put into a common pill-box, into which the air can easily get, and here it will soon become dry; you may either inoculate with it as soon as ever it is dry (and I advise it not to be used while it is wet) or you may then put it into a close box or vial, (for it will keep without spoiling after it has been dried) and use it some days after. It has been known to keep its power of communicating the infection for many months. Half an inch of that part of the thread which has been well soaked in the matter, (and this will be known by its stiffness) must be cut off at the time of use. The person who is to be inoculated, must have the fine edge of a pen knife or lancet drawn along that part of the arm where issues are usually made; and it must go deep enough to make the blood just begin to appear; that is to say, the slightest incision which can be made is sufficient: this small wound should be a little more than half an inch long. In, or rather upon, this, the bit of thread must be put, and a small plaster of what is called the Ladies black sticking plaister, or a plaister of simple diachylon, is all which need be put over it to keep it on.

The inoculation may be performed in both arms for security's sake, least one of the plaisters should happen to come off; though if it were done in only one arm, I believe it would very rarely fail of success. If the person to be inoculated has an issue, the infected thread may be put into that without making any other incision.

Of the Management of the Patient after Inoculation.

After twenty-four hours the plaister and thread may be taken away; and from this time the incision need not be covered with any plaister, or roller, till it begins to inflame and grow sore; when for the ease of the patient it must be defended from the air, and from the rubbing of the cloaths by a bit of what is called in the shops The common plaister.

The inconvenience attending its being covered with any plaister or pultis after the first twenty-four hours is this, that these applications continued for four or five days will occasion a redness on the skins of many people, and in some will cause a considerable degree of erysipelatous (or tettery) eruption. At the time therefore when some appearance of the infection may be expected about the incision, it will be a little doubtful when a plaister has been applied, whether the discolouring and inflammation be owing to the expected distemper, or merely to the plaister. This will keep the patient and his attendants in an unnecessary suspense; and, if there should happen to be no eruption, their uncertainty would be much more perplexing, and might never be cleared up; whereas if such an inflammation came on four or five days after the incision, when no application had been used to the part, there could be no doubt of its arising from the infected thread; and it seems to be the general opinion in England, that a regular inflammation and suppuration of the little wound, proceeding from the infection of the variolous (or pocky) matter, will alone, without any eruption, fully secure the patient from having the Small-pox afterwards. Add to this, that there is not the least use in the applying of any thing to so slight an incision, till it begins to inflame and be sore.

After the plaister is applied, a fresh one may be put on once or twice every day.

If the inoculation should fail of communicating the infection, it may safely be repeated after waiting one month; for if it does not succeed, it does no harm, and the patient is just in the same state with those on whom it has never been attempted.

The inoculated persons may be allowed to go out every day, till the symptoms of the fever begin to come on; the confining them to their chambers immediately after the inoculation is performed, will have no good effect on their general health, and often a bad one on their spirits, and is not attended, as far as I know, with any advantage. But they must still observe the caution before mentioned, of avoiding all fatigue of body or mind. The diet may be the same as in the preparation; and, if the patient has not a stool every day, one drachm or more of kuritive electuary may be taken to procure one.

About the seventh day from the inoculation the patient generally begins to be heavy and languid, to feel weariness, headach, sickness, and the other forerunners of a fever; with all which he is so much oppressed as to find himself easiest in bed all the time that these symptoms continue, which is usually three days.

During this time barley-water, thin gellies, sage or balm tea, toast and water, thin gruel, milk-porridge, or some such liquor is commonly all which can be borne; and there is no occasion to press the patient to take any thing else; but if his stomach would bear he might be allowed almost whatever he would choose, meat and broth excepted.

Besides the complaints already mentioned, young children, just before the Small-pox appears, are apt to fall into convulsions; which seldom fail to occasion some alarm, though they are frequently forerunners of a favorable sort, and are very rarely attended with any real danger.

Troublesome as these symptoms are, it is not often that remedies are required for any of them, except the vomiting; and this is sometimes so continual as greatly to weaken the patient both by the fatigue of it, and by its hindering of him from taking any nourishment.

When this is the case, it will be found by experience that in the variolous (or small-pox) fever, as well as in other fevers, eight or ten grains of ipecacuanha will commonly check, if not entirely stop the vomiting, to the great relief of the patient.

They all vanish of themselves on the third day when the eruption (or breaking out) begins. After which the patient may either lie a-bed, or sit up, just as his strength and inclination prompt him. He must continue to abstain entirely from all liquors stronger than small beer, and from broth and meat of every kind; but may nourish himself with milk, panada, chocolate, Sago, gruels of all sorts, bread, biscuits, puddings, tarts, greens and roots. It will be right for him to drink frequently of some warm diluting liquors, such as thin milk porridge, whey, milk and water, balm or sage tea, toast and water, or warm water sweetened with preserved tamarinds, or any sort of syrup. It is still necessary, that he should have a stool every other day, and this may be commodiously procured, if there be occasion by a clyster of warm water only; a pint and a half will be sufficient for a grown person, and proportionately less for those who are younger.

As soon as the pocks are dry upon the face, the patient may be purged; and a gentle purge should be repeated every third day, till he has taken five. If he should have any cough or soreness of eyes, it will be necessary that he should lose some blood. After the first dose of physic he may begin to eat meat, and to take the air.

FINIS.

Appendix II.

From Pylarinus paper in the Philosophical Transactions, No. XXIX. 1717.

This medical operation which I am going to explain was not first discovered by the Improvers of Physic: but by a rude uncultivated People. It is not known who was the first inventor of it, but it is certain that it was first in vogue in Thessaly, in Greece, and hence, proceeding gradually through the neighboring countries and states, it at last arrived at the City of Byzantium, where it made very little noise for some years at first, and was seldom put in practice and only amongst the common people. But the small pox becoming lately very epidemical the method began to come more and more into practice, but still was never adopted by the people of rank and fashion till a certain Greek nobleman, of the ancient race of the Caryophille in the year 1701, toward the end of winter, asked me seriously what I thought of Inoculation, and whether he would advise me to try it upon his children, for at that time the distemper raged mortally all over the country. I told him I knew not what to say of an affair I was so ignorant of being entirely unacquainted with the new methods, and at the same time desired leave to talk to some operators about it.

Three days afterward when I went to him again . . . presently there came a Greek woman into the room, who explained the whole operation; though she understood nothing of the true cause how the small pox is produced by inoculation. To all this she added experience and innumerable instances of its good success, some of which I had affirmed to me by people of the greatest veracity. She never inoculates except in winter; she is very nice in her choice of the pus for she will by no means take it promiscuously from every subject, but when the disease is epidemical, she takes the pus from ripe pustules of some girl of a good habit, and a favorable kind of pock, pricking it with a pin and squeezing it gently out, and putting into a little shell or glass which must be very clean and not too cold. This little vessel, well covered with a cloth, she puts into the bosom of her servant to be kept warm and as quickly as possible proceeds to the operation. She advizes the air of the room. Proceeding to the operation she pricks the middle of the forehead, the temples, at the roots of the hairs, and also the chin and both cheeks with a steel or, golden needle, spurting it in obligingly and separating the skin a little with the sharp point from the flesh below. Then with the same needle she introduces the pus into the little orifice, and ties a bandage upon the parts.

In the meantime the patient must lie moderately abed and not too much.

No wine or meat allowed until the 40th day.

VESICO-VAGINAL FISTULÆ FOLLOWING HYSTERECTOMY FOR CARCINOMA CERVICIS UTERI, WITH SPECIAL REFERENCE TO THEIR ORIGIN AND CLOSURE.

By John A. Sampson, M. D.,

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The relation between carcinoma cervices uteri and the bladder manifests itself clinically in the following ways:

First, the bladder wall may become involved in the anterior extension of the disease and with the necrosis of the cancerous tissue a vesico-vaginal fistula is formed.

Second, in the frequency of accidental injuries to the bladder in the operative treatment of this condition, there having been 19 such injuries in 158 hysterectomies for carcinoma cervicis uteri in this hospital.

Third, in the frequency of cystitis following the more radical operations for this disease, suggesting that the operation must be considered as an accessory etiological factor in its origin.

In removing the uterus with the parametrium on each side and a portion of the vagina, the bladder is deprived of these natural supports. Blood vessels and nerves going to the bladder are injured or destroyed, as well as similar structures within its walls.

From a study of the anatomical relation between the two organs it can be easily seen that the growth does not have to extend far in order to reach the bladder. The involvement of the bladder by the growth renders the separation of the two organs more difficult, and the surgeon who attempts to save the bladder which is adherent to a cancerous cervix, and at the same time remove the growth, usually fails in both, for the growth returns and the bladder wall is so injured in separating the two organs that either a vesico-vaginal fistula results or a severe cystitis develops because the injured bladder is unable to resist infection.

Cystitis is a most important post-operative complication in these cases on account of the danger of ascending renal infection. The lower ends of the ureters are very near the cervix and the growth does not have to extend far laterally either by direct invasion or by metastasis, to reach or extend beyond the ureters. Clinical experience and a study of the specimens removed by the more radical operations show that the tissue about the ureters should be removed in every instance.[1 2] There are two ways of accomplishing this, either to dissect the ureters free or else to excise the lower 3 to 4 cm. of the ureters with the cervix and implant the renal ends of the ureters in the bladder. If the ureters are dissected free[3 4] or reimplanted in the bladder, their function is temporarily impaired and the kidneys are placed in a condition of lowered resistance and an ascending infection[5] may occur.

Cystitis has occurred in 12 out of 16 cases in which I have followed the bladder conditions after these operations, resulting in ascending renal infection and death in two cases, in one of which the ureters had been resected but not in the other.

The important question arises, how may this post-operative cystitis be avoided? A retention catheter was tried in four cases, but cystitis occurred in all four cases, two of which resulted in ascending renal infection and death. The frequent catheterization of the bladder as a prophylactic measure, *i. e.*, every three to four hours, followed by bladder irrigations as recommended by Baisch,[6] has been tried in nine cases, but in all but one case cystitis occurred, as shown by cystoscopic examinations and taking urine cultures. I began this procedure before the work of Baisch appeared, and while it undoubtedly lessens the severity of the cystitis and so the danger of kidney infection, nevertheless, in my experience, it does not altogether prevent the cystitis. What shall be done in these cases? In three of four cases in which the bladder apparently escaped, an accidental vesico-vaginal fistula was present. In these cases there were no symptoms suggesting cystitis, and the bladder aside from the fistula appeared normal on cystoscopic examination. A patient may have a very marked cystitis, without any symptoms referable to it, as I have seen in some of these cases, where one would obtain cultures of the infective organism from the urine, pyuria would be present, and on cystoscopic examination the bladder mucosa would be "beefy red," covered here and there with a patchy white membrane; and yet the patient might be free from pain or other symptoms which could be referred to the cystitis.

We realize that the formation of a vesico-vaginal fistula our best means of treating severe cystitis, for it relieves the intravesical pressure and permits the bladder to rest. We are employing an old surgical principle for the treatment of infection in any part of the body, *i. e.,* incision and *free drainage,* together with rest of the part diseased; and apparently that is what a vesico-vaginal fistula *with free drainage* does for these cases. As I have written in a previous article,[7] "The excision of portions of the bladder adherent to the growth improves the chances of a cure and the presence of a vesico-vaginal fistula apparently lessens the severity of a post-operative cystitis and the dangers of an ascending renal infection."

It seems to me that the post-operative care of the bladder in these cases should be frequent catheterization, *i. e.,* every 3 to 4 hours, depending on the size of the bladder and the amount of urine excreted in that time. The patients should be catheterized with a two-way catheter and the bladder is irrigated with 200 cc. of sterile salt solution. Urine cultures should be taken at the end of the fourth or fifth day and later every week, and at the same time a cystoscopic examination should be made with the patient in the Sims posture.[8] If the cystitis is apparently mild, nothing further need be done, but if the urine becomes very cloudy and the bladder mucosa looks raw and a patchy membrane forms on the surface, then I think a vesico-vaginal opening should be made just posterior to the internal urethral orifice, and this can be accomplished and afterwards repaired without the use of an anesthetic, as has been described.[7]

Following these operations vesico-vaginal fistulæ may arise, some of which may be accidental and others intentional, the former being made either at the time of the operation in order to make a wide incision of the primary growth and the attempt to repair of the bladder being unsuccessful, or no attempt may have been made to repair it, which I think is especially desirable if the ureters have been resected or the bladder severely injured. A fistula may also have been made after the operation in order to freely drain and put at rest an inflamed bladder. In either instance we are dealing with a vesico-vaginal opening which may or may not close spontaneously.

I have reviewed the cases of hysterectomy for cancer of the uterus here in this hospital, in order to determine the immediate and final results of these cases in which a vesico-vaginal fistula has followed these operations.

Clinical Cases in which a Vesico-vaginal Fistula has followed Hysterectomy for Carcinoma Cervicis Uteri.

Case I.—Mrs. F. C. Age 53. Gyn. No. 1646. Gyn. Path. No. .0141.

Diagnosis. Squamous cell carcinoma cervicis uteri.

Operation, XI, 2, '92. Vaginal hysterectomy. Growth was very extensive and was probably not all removed.

Origin of vesico-vaginal fistula. Accidental; manifested itself by the escape of urine immediately after the operation.

Result. Two attempts to close the fistula were unsuccessful. Patient left the hospital five months after the first operation with the fistula unclosed. Vesico-vaginal fistula closed spontaneously in "a very short time after the patient returned home." Patient died about one year after the operation, from the cancer.

Case II.—Mrs. S. L. Age 38. Gyn. No. 2248. Gyn. Path. No. 62.

Diagnosis. Squamous cell carcinoma cervicis uteri.

Operation, X, 30, '93. Abdominal hysterectomy. Growth extensive and bladder was adherent.

Origin of vesico-vaginal fistula. Accidental; leakage of urine appeared on the third day.

Result. Patient discharged six weeks after operation with a vesico-vaginal fistula which persisted until death, ten months later, from cancer.

Case III.—Mrs. S. R. Age 55. Gyn. No. 6368. Gyn. Path. No. 2611.

Diagnosis. Squamous cell carcinoma cervicis uteri.

Operation, IX, 21, '98. Abdominal hysterectomy. Growth extensive and bladder was adherent.

Origin of vesico-vaginal fistula. Accidental; leakage of urine appeared immediately after operation.

Result. Fistula closed spontaneously one year after operation. Patient died from cancer two years and three months after operation.

Case IV.—Mrs. E. J. Age 46. Gyn. No. 7371. Gyn. Path. No. 3627.

Diagnosis. Squamous cell carcinoma cervicis uteri.

Operation, XI, 22, '99. Vaginal hysterectomy. Bladder involved by the growth.

Origin of vesico-vaginal fistula. Accidental; recognized at the time and repaired with catgut sutures. Unsuccessful.

Result. Fistula closed spontaneously eighteen days after operation. Patient died six months later, from cancer.

Case V.—Mrs. S. B. Age 40. Gyn. No. 7819. Gyn. Path. No. 4074.

Diagnosis. Squamous cell carcinoma cervicis uteri.

Operation, V, 17, '00. Abdominal hysterectomy. Growth extensive.

Origin of vesico-vaginal fistula. Accidental; date of detection of leakage not stated in history.

Result. Fistula closed spontaneously three months after operation. Patient died a "few months later, from general carcinosis."

Case VI.—Mfs. M. L. Age 44. Gyn. No. 7902. Gyn. Path. No. 4138.

Diagnosis. Squamous cell carcinoma cervicis uteri.

Operation, VI, 18,' 00. Combined abdominal and vaginal hysterectomy.

Origin of vesico-vaginal fistula. Accidental; leakage of urine discovered on the fourth day on starting the vaginal packs.

Result. Vesico-vaginal fistula persisted until death, seven months later, from cancer.

Case VII.—Mrs. E. W. Age 38. Gyn. No. 8577. Gyn. Path. No. 4827.

Diagnosis. Squamous cell carcinoma cervicis uteri.

Operation, V, 4, '01. Combined abdominal and vaginal hysterectomy.

Origin of vesico-vaginal fistula. Accidental; repaired with catgut sutures. Leakage of urine following operation.

Result. Fistula closed spontaneously before patient left hospital, V, 28, '01. Living and well May, 1904.

CASE VIII.—Mrs. F. B. Age 36. Gyn. No. 8711. Gyn. Path. No. 4907.

Diagnosis. Squamous cell carcinoma cervicis uteri.

Operation, V, 8, '01. Combined abdominal and vaginal hysterectomy. Extension of growth towards bladder.

Origin of vesico-vaginal fistula. Accidental; leakage of urine discovered on the fourth day, when the vaginal drains were started.

Result. Fistula closed spontaneously in three weeks. Unable to hear from.

CASE IX.—Mrs. J. K. Age 35. Gyn. No. 8733. Gyn. Path. No. 4939.

Diagnosis. Adeno-carcinoma cervicis uteri.

Operation, V, 8, '01. Combined abdominal and vaginal hysterectomy. Extension of growth towards bladder.

Origin of vesico-vaginal fistula. Accidental; recognized and repaired, but unsuccessful. Leakage of urine from the bladder discovered when the retention catheter, which had been placed in the blader at the time of the operation, was removed on the seventh day.

Result. Fistula persisted until death one year later, from cancer.

CASE X.—Mrs. H. J. Age 34. Gyn. No. 9074. Gyn. Path. No. 5232.

Diagnosis. Squamous cell carcinoma cervicis uteri. Pregnancy, four months.

Operation, X, 10, '01. Abdominal hysterectomy, an abortion having been done eighteen days before.

Origin of vesico-vaginal fistula. Accidental; recognized at the time and repaired with catgut sutures. Repair unsuccessful. Date of the appearance of the leakage of the urine not stated in the history of the patient.

Result. Fistula persisted until death, one year and five months afterwards, from cancer. No evidence of a return of the growth in the vaginal vault.

CASE XI.—Mrs. C. W. Age 40. Gyn. No. 9802. Gyn. Path. No. 6019.

Diagnosis. Squamous cell carcinoma cervicis uteri.

Operation, VII, 26, '02. Abdominal hysterectomy, with resection of the lower portion of right ureter, and implantation of the ureter into the bladder.

Origin of vesico-vaginal fistula. Accidental; closure with catgut sutures and fine silk. Leakage of urine discovered on the fourth day.

Result. Two attempts to close the fistula failed. A third was successful, two months after the operation. Patient living and well, V, '04.

CASE XII.—Mrs. V. K. Age 44. Gyn. No. 9903. Gyn. Path. No. 6103.

Diagnosis. Squamous cell carcinoma cervicis uteri.

Operation, IX, 17, '02. Abdominal hysterectomy with resection of the lower ends of both ureters and implantation of the renal ends into the bladder.

Origin of vesico-vaginal fistula. Probably accidental.

Result. Fistula closed spontaneously in about three months. Cancer returned

CASE XIII.—Mrs. S. F. Age 54. Gyn. No. 10,324. Gyn. Path. No. 6843.

Diagnosis. Squamous cell carcinoma cervicis uteri, with metastases to pelvic lymph node.

Operation, III, 18, '03. Abdominal hysterectomy.

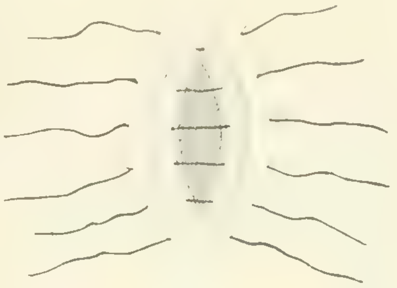

FIG. I.

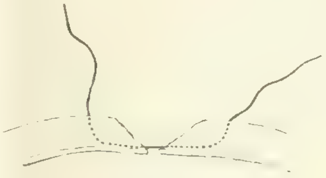

FIG. II.

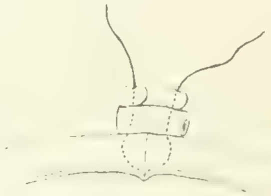

FIG. III.

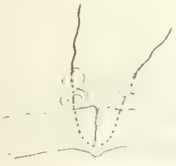

FIG. IV.

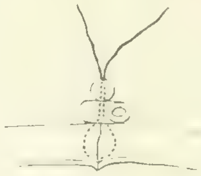

FIG. V.

FIG. I.—Represents the fistula with denuded edges and sutures in place.

The fistula has been lengthened, so that the approximation of the two sides will be more accurate.

The denudation is broad, thus giving a broad area of apposition.

The sutures should be about .5 cm. apart and extend down to but not through the bladder mucosa, and when brought together the bladder mucosa will be inverted. (See Figs. III, IV and V.)

FIG. II.—Cross section through fistula showing the form of the denudation and course of the suture.

The suture as shown passes down to the vesical mucosa and when brought together the bladder mucosa will be turned in.

FIG. III.—"Splinting" Suture.

Two needles were threaded with the ends of the suture and the needles passed through a small piece of rubber tubing, near enough together to approximate well the denuded fistula.

The tubing is held in place by two shot, one on each side of the suture. The elasticity of the tubing maintains the edges of the fistula in apposition without strangulating the tissue, and will take up any slack which may occur if the suture tears the tissue.

FIG. IV.—Another Form of Splinting Suture.

A small piece of tubing is placed in each end of the suture and held in place by a perforated shot. The elasticity of the tubing maintains apposition without strangulation.

This form of suture does not bring the vaginal surface of the fistula together quite as well as the one shown in Fig. III.

FIG. V.—Approximation Suture.

The two ends of the same suture are threaded into the same needle and after passing through the centre of a small piece of rubber tubing are fastened by a perforated shot.

This suture approximates the two surfaces well but has not the advantages of a splinting suture.

Origin of vesico-vaginal fistula. Accidental; convalescence slow. On the ninth day sudden rise in temperature reaching 104.8°. On pelvic examination there was found to be an accumulation of fluid posterior to the bladder, which proved to be urine, which had become encapsulated. This was opened and a large opening was found in the bladder, communicating with the encysted urine.

Result. Large fistula partially closed. Three further attempts to close the small fistula remaining, failed. Fistula persisted until the patient returned six months later, when the opening was successfully closed. In all the operations for the closure of the vesico-vaginal fistula, an anesthetic was not used, the previous operation apparently having rendered these parts insensible to pain. Patient living and well, VI, '04.

Case XIV.—Mrs. F. B. Age 39. Gyn. No. 10,627. Gyn. Path. No. 6885.

Diagnosis. Squamous cell carcinoma cervicis uteri.

Operation, VIII, 3, '03. Abdominal hysterectomy.

Origin of vesico-vaginal fistula. Accidental. Extension of growth towards bladder. Leakage of urine since operation.

Result. Two attempts at closing the fistula unsuccessful. Both without even a local anesthetic; bladder and vagina apparently insensible to pain. Fistula still present when last heard from, XII, '03.

Case XV.—Mrs. M. J. Age. 35. Gyn. No. 11,134. Gyn. Path. No. 7370.

Diagnosis. Squamous cell carcinoma cervicis uteri.

Operation, III, 31, '04. Abdominal hysterectomy.

Origin of vesico-vaginal fistula. Formed on the ninth day without the use of even a local anesthetic, in order to relieve cystitis. Making of fistula did not cause any pain. Patient did not know when it was done.

Result. Fistula successfully closed one month later. No pain, not even a local anesthetic used.

Case XVI.—Mrs. L. S. Age 37. Gyn. No. 11,234. Gyn. Path. No. 7468.

Diagnosis. Squamous cell carcinoma cervicis uteri.

Operation, V, 5, '04. Abdominal hysterectomy, with resection of the base of the bladder and reimplantation of the ureters into the bladder. The opening caused by the resection of the base of the bladder was filled in by the fundus of the bladder which was drawn down and sutured in place.

Origin of vesico-vaginal fistula. Fistula admitting small probe formed just posterior to the internal urethral orifice. Still present two months later.

There have been 16 instances of vesico-vaginal fistulæ following 158 hysterectomies for carcinoma cervicis uteri, of which 14 were accidental. Of these 14 accidental cases, 5 were recognized at the time of the operation and repaired, but the operation was unsuccessful. In 4 of the 5 cases catgut sutures were used, while in the fifth case the form of suture material was not stated in the description of the operation. In the other 9 cases the injury was not discovered until after the operation. In some cases the leakage of urine was noticed immediately after the operation, while in others it did not appear until later when the gauze drains were started, as on the third or fourth day; and in Case XIII an accumulation of urine occurred which was not recognized until it was opened on the ninth day, and thus a vesico-vaginal fistula was established.

I have been able to find in our records five other instances of injury to the bladder during hysterectomy for carcinoma of the cervix of the uterus, and two additional instances in which the bladder was injured, but the operation was abandoned because the growth was too extensive. In two of the five cases, Gyn. Nos. 3609 and 8387, the patients died as a result of the operation. In the first case there was a leakage of urine before death, the patient dying on the fourth day; in the second case the patient died within twenty-four hours. In both of the above cases the bladder was repaired with catgut sutures. In two of the other three cases the opening was repaired with catgut (Gyn. Nos. 5851 and 6685) and in the other case (Gyn. No. 2591) with fine silk; and in all three cases healing occurred without leakage. In the two cases in which the bladder was accidentally opened, but the operation had to be abandoned on account of the extent of the growth, the opening in the bladder was closed with catgut and no leakage occurred. In a few instances the bladder has been intentionally opened during hysterectomy for carcinoma cervicis uteri, either to determine the extent of the disease or to catheterize the ureters. These incisions have been closed either with catgut or fine silk and in some cases both forms of suture material were used. The only instances of accidental injury to the bladder, in hysterectomy for cancer of the cervix, where the injury has resulted in a vesico-vaginal fistula, which I have been able to find in our records, are the first fourteen cases previously referred to in this article. A study of these cases teaches us that the bladder is apt to be injured in hysterectomy for cancer of the uterus, and that while this injury may be recognized at the time and repaired, a vesico-vaginal fistula may result, as occurred in 5 out of 8 cases. On the other hand, the injury may not be recognized until afterwards, as occurred in 9 cases.

The Immediate Repair of Injuries to the Bladder during Hysterectomy for Carcinoma Cervicis Uteri.

The bladder has a good blood supply and usually it may be incised and the incision closed, and if care is taken healing will occur without leakage. When the bladder is injured in hysterectomy for carcinoma cervicis uteri it usually indicates that the growth has involved the bladder and that the difficulty in separating the two is responsible for the torn bladder. When this injury is repaired, one must close an opening in a portion of the bladder wall whose outer coats have been torn or partially removed and where the blood supply has been greatly injured, frequently so badly that healing of the repaired opening fails to occur and a fistula takes place, as occurred in 5 of the 8 cases previously referred to. In addition the dangers of leaving cancer tissue behind are great. If one wishes to repair these injuries successfully, it will be necessary to excise the portion of the injured bladder wall and suture together bladder tissue whose blood supply is good; and by so doing cancerous tissue will be removed in many instances.

We realize how frequently cystitis occurs in these cases and that the lowered resistance of the bladder must in great measure be responsible for it, and this lowered local resistance is brought about by the removal of the natural support afforded to the bladder by the cervix and vagina. In addition the blood supply of the base of the bladder is injured by the ligation of vessels supplying vesical arteries and by the injury of vessels in the outer coats of the bladder and nerves are also destroyed. If the cervix is adherent to the bladder, then the injury to the bladder may be very great and after the operation the entire base of the bladder wall will be very thin and so injured that it will not only be unable to resist infection but its function will be so interfered with that it will be unable to contract. We realize that patients are usually unable to void urine immediately after these operations, and I attribute it to the large area of the bladder wall which must be thrown out of function by the operation, and not entirely to the destruction of nerves supplying the bladder; for in one instance where I resected the entire trigonum and made a new one by bringing the fundus down and suturing it to the internal urethral orifice, the patient was able to void urine spontaneously after the operation. In this case the area of bladder wall which is usually injured by the operation had been excised and healthy bladder tissue had been sutured in its place. It hardly seems justifiable to excise the entire base of the bladder in every case of carcinoma of the cervix, because one fears the operation may so injure the base of the bladder as not only to prevent the contractions of the bladder, but also, owing to its being a place of lowered resistance and becoming infected, to cause cystitis and thus expose the individual to the chance of an ascending renal infection; for in many instances the interference with the function of the bladder is only temporary and the cystitis is very mild. Nevertheless, in those cases in which the cervix is so adherent that the separation of it from the bladder must obviously so injure the portion of the bladder adherent to the cervix as both to greatly interfere with the function of the bladder and so cut off the blood supply of the portion of the bladder as to favor the occurrence of a severe cystitis, then it is best to excise this portion of the bladder; for afterwards a healthy bladder tissue can be brought together and the function of the bladder will not only be interfered with less and the dangers of cystitis minimized, but also there will be a wider excision of the primary growth and so a better chance for a permanent cure.

I think that fine black silk is a better suture material than catgut, and if care is taken to turn the bladder mucosa in there is very little danger of leakage, and one may expect a satisfactory closure in every instance.

The post-operative care of such cases has already been referred to. It requires frequent catheterization, *i. e.,* every 3 to 4 hours, depending on the capacity of the bladder and amount of urine excreted, followed by bladder irrigations of 200 cc. of sterile salt solution. I tried a retention catheter in four cases (in only one of which the bladder had been injured and repaired) and a severe cystitis occurred in all four cases, resulting in ascending renal infection and death in two cases. Against a retention catheter it may be said that it may fail to drain, due either to its having become occluded or being pushed too far in the bladder, in which latter case the bladder will have to be filled with urine before the fluid can reach the end of the catheter. In addition, the catheter acts as a foreign body in the bladder.

In some cases, it is best not to close the opening in the bladder entirely or else after the closure of the area of the bladder excised, to make another opening through the trigonum, where the drainage of the bladder can be best maintained, and also where the opening is more easily reached should it be necessary to close it later. The presence of a vesico-vaginal fistula seems to me to be especially indicated in those cases where there has been an extensive resection of portions of the bladder and also where the ureters have been resected and reimplanted in the bladder in order that the intra-vesical tension may be relieved and the bladder placed at rest.

The Closure of Vesico-vaginal Fistulæ following Hysterectomy for Carcinoma Cervicis Uteri.

Two forms of vesico-vaginal fistulæ following these operations must be considered:

1. Those which are discovered after the operation or which result from the unsuccessful repair of injuries recognized at the time of the operation. In these cases the fistula is apt to be in a portion of the bladder wall whose blood supply has been injured and outer coats have been partially destroyed.

2. Those which have been purposely left open at the time of the operation or have been made afterwards to relieve cystitis, as has been described. These fistulæ should be surrounded by healthy bladder tissue.

In either case there is present a vesico-vaginal fistula which should be closed. A certain number of post-operative vesico-vaginal fistulæ will close spontaneously. This occurred in 7 of the 16 cases, 3 (Cases IV, VII and VIII) closing in three weeks, 2 (Cases V and XII) in three months, 1 (Case I) in six months, and another (Case III) at the end of a year. On the other hand, 4 cases persisted until the death of the individual at the end of seven months, ten months, one year, and a year and a half (Cases VI, II, IX and X). Three cases were successfully closed, one at the end of one month, first attempt (Case XV), another at the end of two months, after three attempts (Case XI), and another at the end of 6 months (Case XIII), after four failures. Of the other two cases one was still present six months after the operation (Case XIV), and another is still open two months after the operation (Case XVI).

It is evident that a vesico-vaginal fistula after it has served its purpose of relieving the intra-vesical pressure and resting the bladder, is very undesirable, especially if it exists for a long period of time. A spontaneous closure of the fistula is the easiest solution of the difficulty, but one does not care to wait six months or a year to have this accomplished, and many will never close spontaneously. It seems best if the fistula is in a position where it will close spontaneously that it should be left to do so; on the other hand, a fistula, unless very small, situated near the center of the trigonum, where the closure of the vaginal walls can never reach it, is not apt to close, no matter how long one waits.

Certain difficulties present themselves in the closure of these fistulæ. The fistula is apt to be situated in bladder tissue which has been so injured by the operation that its blood supply is poor and healing is very difficult, and the attempt to close such a fistula immediately after the operation is apt to result in failure. In Case I two attempts to close the fistula failed; in Case XI the first two attempts failed, while the third, made eight weeks after the operation, was successful. In Case XIII four attempts made after the operation failed; on the other hand, the fistula was successfully closed six months later. In Case XIV three or four attempts made immediately after the operation failed, the fistula being still open six months afterwards. In Case XV the fistula was closed one month after making it (to relieve a cystitis). The fistula being in good bladder tissue, the closure was easy to accomplish. It seems to me that one should wait at least two months after the operation before attempting to close a vesico-vaginal fistula, for two reasons: first, the fistula may close spontaneously and the operation may be unnecessary; and second, the blood supply of the tissue will have time to be restored and the probability of a successful operation is assured.

Description of Operation for the Closure of Vesico-vaginal Fistulæ.

So much has been written about the closure of vesico-vaginal fistulæ that it seems almost useless to consider the subject again. Vesico-vaginal fistulæ vary in size, situation and the condition of the tissue in which they are situated; whether in healthy bladder tissue, or very thin tissue, or dense scar tissue, so that the operative treatment of this condition must be determined according to the demands of each individual case.

In order to successfully close vesico-vaginal fistulæ the following requirements are essential:

1. An approximation of the tissues without tension.
2. A broad area of denudation, exposing healthy tissue in such a manner that when the edges of the opening are brought together, the bladder mucosa will be inverted.
3. Accurate approximation with inversion of the bladder mucosa.
4. Tying the ligatures without strangulation of the tissue included in the ligature.

Failure to carefully observe any one of the above requirements is very apt to cause the operation to be unsuccessful.

Approximation without tension is most essential and this should be the first step in the operation. Unless this is accomplished the operation will surely fail and the fistula may be made larger instead of smaller by the operation. This may sometimes be accomplished by freeing the bladder, and by tension sutures, and in two instances of post-puerperal vesico-vaginal fistulæ, where the fistulæ involved the internal urethral orifice, I partially resected the urethra and *drawing up the freed urethra* reimplanted it into the opening in the bladder which had been made smaller in order to fit the end of the urethra. Some cases require multiple operations to cure the condition and many plastics have been devised to fill in the opening in the bladder where it has been impossible to bring the edges of the fistula together.

A broad area of denudation is also most essential, and this must be in healthy tissue or union will fail to occur and the sutures will cut through. In denuding the edges of the fistula, the denuded surface should slope from without inward so that when the edges of the fistula are approximated the vesical surface of the fistula will meet first and when the ligatures are tied the bladder mucosa will be inverted.

In order to assure an accurate approximation, the fistula should be converted into such an opening that the approximated edges will accurately fit each other. In order to do this it may be necessary to lengthen the fistula so that the two sides will meet at an acute angle and not in the form of a rounded border. The sutures should be placed the same distance apart upon the two sides and should go down to but not through the vesical mucosa, so that when tied the mucosa will be inverted, as shown in Figs. 1, 2 and 3.

Last, but not least, the sutures should be tied so as not to strangulate the tissue included within them. All other requirements may be fulfilled but this and if the sutures are tied too tightly the tissue will be killed and the wound break down and the operation fail.

I wish to describe a method of fastening the sutures, which apparently combines the advantages of a "splint" with that of a "suture" and approximates the edges of the wound without strangulation, and inverts the vesical mucosa. The suture material used is very fine silver wire, and the sutures are all passed as shown in Fig. 1, beginning 3 to 4 mm. back of the edge of the denuded area, going down to the bladder mucosa and then across the fistula, and entering the denuded area of the opposite side just beneath the bladder mucosa, and coming out in the vaginal mucosa at a point corresponding to the point of entrance of the needle on the other side. The sutures are fastened in the following way: Rubber tubing is used 3-5 mm. in diameter. That obtained from a male rubber catheter of that diameter has about the right consistency. This rubber tubing is cut into small pieces .5 to 1 cm. in length. If one wishes a "splinting" suture a needle is placed on each end of the wire suture and the needles are passed through a longer piece of rubber tubing, about .6 cm. apart. The rubber tubing is now pushed down the two wires and each wire is shotted, using just enough pressure on the tubing to slightly dent it (see Fig. 3). As can be seen, this suture serves as a splint; the edges of the fistula are approximated, and the elasticity of the pieces of rubber tubing maintains the approximation and prevents strangulation. If one wishes an "approximation" suture only, a smaller piece of tubing may be used and both pieces of wire may be threaded in one needle, passed through the tube and fastened with one shot, as shown in Fig. 5. I have tried other methods of fastening the piece of tubing on the wire, one of which is to place a separate piece of tubing on each end of the wire, as shown in Fig. 4. This latter method of obtaining a "splinting" suture has the disadvantage that it does not approximate the vaginal surface of the fistula as well as the one first described unless the shot is pushed tightly down on the tubing, and when this is done the piece of tubing may become imbedded in the vaginal tissue. In most of the cases tried I have combined the "splinting" with the "approximation" suture, alternating the two, but I think that the form of suture first described meets all requirements.

I have used this method of closing vesico-vaginal fistulæ in eight cases, with only one failure. In three cases the fistula followed hysterectomy for cancer of the uterus. Cases XIII, XIV and XV of the cases reported in this article. In Case XIII the fistula was closed six months after the first operation. In case XIV the operation failed because the edges of the fistula were very thin and the tissue was in poor condition, and the attempt was made too soon after the first operation. Case XV, the fistula had been made to relieve a post-operative cystitis and was closed one month afterwards when the bladder condition had been relieved. This method was used successfully in the closure of four vesico-vaginal fistulæ which had been made to relieve a severe cystitis, Gyn. Nos. 10,579, 10,701½, 11,140 and 11,164, and also in the closure of one post-puerperal vesico-vaginal fistula, Gyn. No. 11,129, in which two previous attempts at another hospital had failed. I have used other suture material successfully in the closure of vesico-vaginal fistulæ, such as fine silk, silkworm gut and catgut, but prefer very fine silver wire, on account of its great pliability and aseptic qualities. I have also successfully closed vesico-vaginal fistulæ in other ways, as, in layers, using buried sutures of fine catgut and vaginal sutures of silkworm gut, Case XI in this article having been closed by this method.

Position.—Use the position best adapted to the individual case. In some, the dorsal position is very good, in others the best exposure may be obtained in the knee-breast posture. The position which I have found very serviceable is the lateral, left (Sims) or right, choosing the side giving the best exposure. If the hips are elevated one can usually combine many of the advantages of the knee-breast with those of the lateral, the vagina and bladder distending well, and the bleeding accumulating back in the vagina or flowing into the bladder, out of which it can be washed after the operation.

Post-operative Care.—The same care is used as in those cases where the bladder has been injured during operations and repaired. This consists in frequent catheterization with a two-way catheter followed by bladder irrigations. I think that the class of cases demanding the use of a retention catheter is very small and the disadvantages of the retention catheter have already been referred to.

Anesthetic.—The advantages of a general anesthetic lie in the increased amount of relaxation obtained and thus the better exposure and also the fact that the patient is unconscious of the operation. These factors make the task easier for the operator, and ensure better work. Against a local anesthetic such as cocaine it may be said that the local infiltration of the edge of the fistula distorts the tissue and interferes with the nicety of the operation, and the patient being conscious is not as relaxed as under a general anesthetic. I have closed vesico-vaginal fistulæ with cocaine as a local anesthetic, and although it can be done, the infiltration of the edge of the fistula with the solution interferes with the accuracy of the denudation and approximation of the denuded surfaces.

THE CLOSURE OF VESICO-VAGINAL FISTULÆ WITHOUT AN ANESTHETIC.

In various publications[5 7 8] I have called attention to the fact that these more radical operations apparently lessen the sensibility of the vagina so that the bladder may be opened and closed without pain to the patient; this is especially true if the opening is made in the bladder above the vagina, *i. e.*, in the portion of the base of the bladder exposed by the removal of the uterus and vaginal cuff. I have studied the sensitiveness of the vagina to pain in over 75 women, using a right-angle tenaculum or mouse-tooth forceps for the purpose, and found the vagina much less sensitive to pain than the vulva, which is very sensitive. There is great variation in different people. In some the vagina is relatively insensitive, so much so that portions of the vaginal mucosa may be excised, as in anterior and posterior colporrhaphies, with very little discomfort to the patient. In other cases pinching with forceps or sticking the vaginal mucosa with sharp instruments causes a great amount of pain. This is not dependent on the women having given birth to children, for I have found the vagina of some nullipara relatively insensitive and also the vagina of some multipara quite sensitive to pain. The practical bearing of this condition in these cases is that these operations render the vagina still less sensitive, so much so that the bladder may usually be opened and closed without hurting the patient. As most of the patients who suffer from cancer of the cervix have had children, the outlet is relaxed and a suitable exposure can usually be obtained, and thus the patient may be saved the dangers and discomforts of a general anesthetic and the local distortions of a local anesthetic may be avoided.

CONCLUSIONS.

I. The anatomical relation between the cervix and bladder is such that the anterior extension of carcinoma cervicis uteri soon invades the bladder wall, as shown by:

1. Vesico-vaginal fistulæ, which may occur in the advanced cases and result from the necrosis of the growth, which has invaded the bladder wall.

2. Accidental injuries to the bladder occurring during hysterectomy for cancer of the uterus.

3. Cystitis following these operations, demonstrating that the operation must be considered an accessory etiological factor in its origin.

II. The surgeon who attempts to separate a carcinomatous cervix which has become adherent to the bladder, usually:

1. Leaves cancer tissue behind, and the disease returns.

2. So injures the bladder wall that a vesico-vaginal fistula may form, which if recognized and repaired at the time, is apt to fail to unite, because the fistula is situated in a portion of the bladder wall whose outer coats have been torn and whose blood supply has been injured by the operation.

3. If he does not produce a fistula the injured portion of the bladder may be unable to resist infection and a severe cystitis may result.

III. On account of the above, *if the cervix is adherent to the bladder the portion of the bladder wall adherent should be excised*, in order:

1. That a wider excision of the primary growth may be obtained.

2. That the injured bladder wall may be repaired, for one may then unite healthy bladder tissue together and so feel assured of a successful repair of the injury.

3. That the bladder may be better able to resist infection, for the portion of the bladder weakened by the operation has been removed.

IV. Post-operative vesico-vaginal fistula may occur:

1. From undiscovered accidental injuries to the bladder or the failure of the repair of injuries recognized at the time of the operation.

2. From the intentional formation of such fistulæ at the time of the operation in order to relieve intra-vesical tension and give the bladder a rest, and also the formation of fistulæ after the operation in order to minimize the dangers of post-operative cystitis.

V. Frequently post-operative vesico-vaginal fistulæ close spontaneously. This may take place in a short time, as a few days or weeks, or may require as long a time as six months or a year; on the other hand, some will never close.

VI. Apparently the early operative closure of such fistulæ, unless in healthy bladder tissue, is difficult, and operative measures should not be undertaken until the tissue has had a chance to regain its natural blood supply. One should probably wait at least two months before undertaking such steps.

VII. The radical operations for cancer of the uterus diminish the sensibility of the vagina and bladder to pain, so that post-operative vesico-vaginal fistulæ may be closed without the use of a general or local anesthetic.

VIII. The following principles should be employed in the closure of these and all vesico-vaginal fistulæ.

1. Approximation without tension.

2. A broad area of denudation exposing healthy bladder tissue.

3. Accurate approximation with inversion of the bladder mucosa.

4. Tying the ligatures so as not to strangulate the tissue.

IX. Very fine silver wire fastened by means of perforated shot form a very satisfactory suture material, and if a small piece of rubber tubing is placed between the shot and the vaginal mucosa a most efficient "splinting" suture is formed, which, through the elasticity of the rubber tubing, maintains accurate approximation without strangulation.

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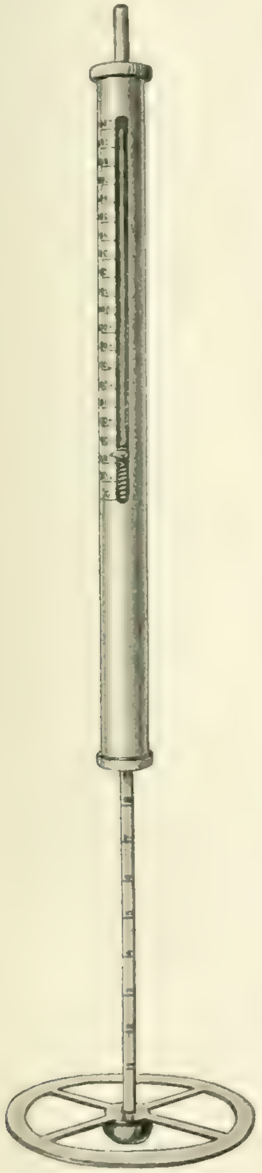
THE PIEZOMETER, AN INSTRUMENT FOR MEASURING RESISTANCES.

By Howard A. Kelly, M. D.,

Baltimore.



I here exhibit a new instrument intended to register varying degrees of resistance, which, adopting the name already in use, I have called a *piezometer.* Its purpose is to substitute a simple, scientific, objective means of demonstrating pressure for the subjective methods, depending on the use of the fingers, which are now in use. The piezometer consists of a slender, graduated rod, about 30 cm. in length, divided into centimeters from its lower end up to a metal cylinder, about 13 mm. in diameter and 18½ cm. in length, in which the upper part of the rod is enclosed. This cylinder has a fenestrum about 10 cm. long, in which slides an indicator attached to the rod that when not in use is held at the lowest point, where it registers zero, by a well-tempered spring. The distance from the zero mark to the upper end of the fenestrum is graduated by hundreds up to two kilometers. On the rod, between the button at its lower end and the cylinder, a fenestrated wheel slides freely. The instrument is intended, as I said, to estimate varying degrees of resistance, and thus ascertain the amount of pressure necessary to elicit tenderness, while at the same time, by means of its wheel, it registers the depth of the depression made on the skin surface.

I am indebted to Dr. Emil Schmoll for calling my attention to the only instrument which, so far as I know, presents any points of similarity to the piezometer. It is the algesimeter of Boas (*Diagnostik und Therapie der Magenkrankheiten,* Leipzig, 1894, p. 75), a little instrument, about 10 cm. in length, consisting of a piston traveling in a cylinder with an indicator registering pressure from one-half kilo to ten kilos in amount, and intended to estimate the sensitiveness to pressure over the stomach and upper abdomen. It lacks any provision, however, for measuring the resistance of the abdominal wall, or the depression in the wall made by any given degree of pressure.

There are two ways of using the piezometer for the purpose of outlining an abdominal tumor. In the first place, a given degree of pressure, say 800 to 1000 grams, may be used, and the depth of the impression afforded by it noted, as registered by the wheel. So long as the pressure is made over a tumor, only a slight depression, say 1 to 1.5 cm. is registered, while as soon as the same degree of pressure is made over the soft parts of the abdomen, beyond the margin of the tumor, the tip of the rod sinks in as much as 2 cm. or more. This manner of using the instrument makes it possible not only to measure the degree of pressure made, but to demonstrate it to the bystanders, whereas, by simple palpation, although an experienced observer is able to appreciate the amount of pressure conveyed to the tips of his fingers, he establishes it in a purely subjective manner, and is able to give it expression in only a vague, if not an inaccurate manner.

The second purpose for which the piezometer can be used is that of estimating the degree of rigidity in the right iliac fossa in a doubtful appendicitis, by comparing the rigidity of the right and left oblique muscles. For example, with a pressure of 500, the button on the end of the rod may indent the abdominal wall so that the wheel registers 1 cm. (e. g.) on the right side, while, at a corresponding point on the left side, it registers 1½ or more. In this way the rigidity is demonstrated beyond a question, and no allowance need be made for difference in tactual sense. Again, the piezometer may be used as an algesimeter, simply to determine how much pressure is necessary to elicit tenderness over the appendix, while with the graduated rod and the wheel, the depth of the depression is estimated at the same time, which makes a much more satisfactory comparison. The piezometer should also have a field of special value in teaching physical diagnosis to classes, because, since it is far more delicate than the untrained sense of touch, varying degrees of resistance can be demonstrated by means of it, after which palpation can be employed in order to train the sense of touch.

Finally, let it be understood that the instrument is intended, not to replace the method of palpation, but to supplement or to confirm the results obtained by it.

THE JOHNS HOPKINS HOSPITAL BULLETIN.

The Hospital Bulletin contains details of hospital and dispensary practice, abstracts of papers read, and other proceedings of the Medical Society of the Hospital, reports of lectures, and other matters of general interest in connection with the work of the Hospital. It is issued monthly.

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DR. RICHARD BROOKE, THE FIRST SCIENTIFIC OBSERVER IN MARYLAND.

By Bernard C. Steiner, Ph. D.,

Associate in History, Johns Hopkins University.

This pioneer title may well be given to Dr. Richard Brooke, son of Major Thomas Brooke and his wife Lucy (Smith) Brooke,[1] who was born near Nottingham, Prince George's County, Maryland, June 2, 1716, and died July 12, 1783. He graduated in medicine, with the degree of M. D., at an unknown university,[2] and practiced his profession in his native county. Marrying late in life, on Nov. 1, 1767, Rachel Gantt, daughter of Dr. Thomas and Rachel (Smith) Gantt, of Calvert County, he had two children: a son, Frederick Thomas, who was born July 27, 1770, and moved to West Virginia; and a daughter, Sarah, who married Samuel Harper, of Alexandria, Va. Mrs. Brooke died on June 28, 1793.

Dr. Brooke took an active part in politics and incurred the enmity of the Proprietary Governors by his opposition to their acts. Before 1750, he sent a memorial to the President of the Privy Council, "in which it is alleged" that Charles Lord Baltimore "did in a peculiar manner countenance and encourage the Roman Catholicks" in Maryland.[3] In a letter of April 19, 1761, Gov. Horatio Sharpe referred to this memorial and spoke of Dr. Brooke as a "flaming zealot against Papists and railer against the Lord Proprietary." Dr. Brooke is said to have made several voyages to England in the interests of the province, which voyages he refers to in his will. In this will he requests that the Legislature should see that its provisions were fairly executed, "in recognition of the services I have rendered and the large sums of money expended for my countrymen."[4]

Dr. Brooke was a contributor to the Philosophical Transactions[5] in London and to the Gentleman's Magazine, and wrote on medical and scientific as well as on political subjects. The first article found of which he was the author appeared in 1752, on "Inoculation without incision."[6]

In 1747, Dr. Brooke inoculated a young gentleman, then about 20 years of age, and made a slight incision on the biceps muscle, in which he laid the "lint impregnated with variolous matter." The bandage was too loose and the lint shifted from the wound, but Dr. Brooke found that the "part, whereon the lint lay after its removal, was inflamed and full of red pimples," and the patient went "through the different stages of the disorder, without the least threatening symptom." Dr. Brooke then tried with great success among children to "convey the disorder without making an incision, but merely applying the infected lint to the arm and confining it with adhesive plaster." Apparently he did not try the plan with adults, but he suggests that, "though the density of the pores" may be too great in their case for such infection, yet friction may be used to make "the cuticle as thin as we please."

The Philosophical Transactions adds that Dr. Brooke's experiment was tried unsuccessfully on children in London.

In 1755 he sent to the Royal Society[7] a "Thermometric Account of the Weather" from September, 1753, to September, 1754. This is the first series of such observations extant, which were made in Maryland, and showed a yearly variation of 78° F., a monthly variation of 58° F., and a daily variation of 25°. He also took barometric observations, and in transmitting the record of his work to his friend, Dr. J. Bevis, of London, gave reasons for expecting a very severe winter, *e. g.*, there is an abundant crop of wild grapes, the summer has been "the wettest that is remembered by any man," the winter succeeding a hard one in Europe is apt to be severe in Maryland, and a warm autumn with southerly winds is apt to bring a cold winter. The year previous had no day of extreme heat or cold, so that the weather had been more like that in England than usual.

In the same letter, Dr. Brooke regrets that a ground hog, which he intended to send Dr. Bevis, had escaped after the three months that the animal was kept in the vain attempt to find a "captain of a ship that would take charge of him."

The letter also gives the intelligence that intermittent fevers have been very common that autumn, and though they yield to the bark, some patients, "after the fevers have left them," are affected with slight touches of a catalepsy, "which is worse at the full & the change of the moon."

In the succeeding February, Dr. Brooke wrote again, stating that his prognostications of a severe winter had proven correct and "that pains at the breast and bowels, spitting of blood and eruptive fevers, the two former diseases especially, have been very frequent." The "small pox have of late been for the most part favorable." He regrets exceedingly the failure of a bill at the last session of Parliament for establishing a "general bill of mortality throughout the nation," and trusts that such a bill may soon be passed, as one person can have little certainty "respecting the reigning diseases and the general influence of the weather upon them."

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[1] Bowie's "Bowies and Their Kindred," 363.

[2] 25 Gent. Mag., 54.

[3] 2 Sharpe Correspondence, 501.

[4] "Bowies and Their Kindred," 363.

[5] Dr. Quinan discovered the articles in the Philosophical Transactions, and refers to them in Md. Med. Jour., June 23, 1883, and Dr. E. F. Cordell mentions them in his "Medical Annals of Maryland," pp. 650, 652, 653, 654. Mr. O. L. Fassig discusses Dr. Brooke's observations at some length in 3 Climate and Crop Service, Md. and Del. Section, No. 12, p. 3. (See also 1 Md. State Weather Service Reports 348.) In this article, he also discusses Dr. Brooke's observations from 1754-1757 referred to below. He reprints Dr. Brooke's meteorological papers in the Gentleman's Magazine in 3 Climate and Crop Service, Md. and Del. Section, No. 5, p. 3 and No. 6, p. 3.

[6] 47 Philosophical Transactions, 470.

[7] 51 Philosophical Transactions, 58; 25 Gent. Mag., 54.

In 1756, he wrote[8] of a remarkable effect of a bolt of lightning, which struck the iron weather cock on the cupola of the brick house belonging to Mrs. Addison, "a widow lady in our neighborhood." He gives a cut of a form of lightning rod, which is used in Virginia, and asks whether such "are like to be dangerous or useful?"

In 1752, he had begun[9] contributing to the Gentleman's Magazine, sending a recipe to destroy lice in a child's hair by rubbing the powdered bark of sassafras root among the hair and tying up the head in a handkerchief over night, to prevent the powder from falling out. He also told of a cat at Mr. James Greenfield's, in Maryland, who gave suck to a young rat along with her kittens,[10] of the method of tanning leather in Maryland, and of his own successful experiment of preventing maggots swarming in cases of amputation by daily sprinkling wheat flour "over the pledget."

In a third article,[11] he told how he cured a young lady of a "pimple in the roof of her mouth about the bigness of a small pea." After failing "with gargles & doses of salts" for two months, he induced her to drink a draught of water every day, while previously she would not drink for seven days consecutively. The water cure was effectual.

In 1759, Dr. Brooke sent to the Royal Society a thermometric account of the weather for the three years, September, 1751, to December, 1754. The account is interspersed with accounts of the climatic and hygienic conditions of the province. The dry summer of 1755, an earthquake shock in the fall of that year and a tornado on June 22, 1756, are also chronicled. The last did incredible damage in several parts of the county, blew down 200 houses, killed "many people in St. Mary's County & extended as far as New York & Virginia."

In May and June, 1756, he observed an epidemical spotted fever, from which he heard of no deaths, and an epidemical disorder among dogs, in the nature of an epizootic. The disorder continued throughout the summer. In September, Dr. Brooke saw a tame fox very ill with this disease. He gave him a "dose of a valuable powder, with which I have done much good & for the knowledge of which I was indebted to my worthy friend, Dr. Parsons, when I was last in England. The powder had cured dogs, but the fox died within three minutes of the time of taking it, which death Dr. Brooke attributed to the punch, in which he gave the powder.

The summer of 1756 was the hottest and dryest ever known in Maryland, and "putrid bilious fevers" and an "hepatic dysentery" raged. Dr. Brooke gave Dr. Parsons' powders to his patients, in connection with an opiate (*pil. mathaei*) and a few doses of astringents, and had great success. Small pox and swine pox were also prevalent, but in a mild form. In December, Dr. Brooke fell ill, and so contined for twenty-seven days, suffering from a fever, cough, and "spasms of the muscle trapizeus," from which last complaint he found relief "by drinking punch, into which Goa Stone had been plentifully grated." In February, 1757, he encountered a disease among the negroes, beginning with "pains in their heads, necks, shoulders, breasts, or bellies," and usually developing into a "hard & sensible tumor" in the triceps muscle of the thigh. "There was a high fever during the time." "Emollient plasters would commonly remove the tumor in two days' time," but afterwards a tumor usually developed in the ham or calf of the leg, which tumor was generally "repelled" by the same "cataplasms & the patient would get well usually in about a fortnight." In one case, that of a negro boy, "the matter descended to the foot," which suppurated and was very hard to heal.

In April, 1757, Brooke found "impetiginous disorders common," and, in June and July, many were "troubled with imposthumations under the arm all in the *axilla dextra*." "Almost every patient, in whatever disorder, had more or less of bilious symptoms." Inflammations of the neck of the bladder were very common, but were "cured by anti-phlogistic medicines." In August and September he had a number of patients who "were taken with a violent pain in the *os frontis* on the left side. The pain soon fell into the eye on the same side and occasioned a dimness, but this and the pain were soon removed by an epispastic behind the ear, if applied early." In one case, "a negro wench" had had the the complaint so long that she was totally blind, but Dr. Brooke cured her by "caustics behind the ear & vitriollic collyricums." In October a pestilential fever raged among horses along the salt waters of the Chesapeake, but apparently did not affect those in forest pastures.

In the Maryland Gazette for Nov. 4, 1762, Dr. Brooke wrote advising that bleeding and mercury be used in cases of hydrophobia, and that the wound be scarified. A year later he sent a communication of some length to the Gentleman's Magazine,[13] setting forth his opposition to the Proprietary Government of Maryland. He claimed that property in the province was not secure, when such enormous powers were vested in the junto of the Proprietary and his officers. Nine of the twelve councillors enjoyed offices which amounted to near £4000 pounds sterling and so were partial to Lord Baltimore. The Legislature consisted of four parts, of which the Proprietary had three: himself, his Governor and his Council. The Upper House, or Council, had rejected the Lower House's bill that there be a Provincial Agent in England, but Cecilius Calvert, Lord Baltimore's uncle and agent, represented the Proprietor and not the province, and so the desired position was not filled. The Governor was also the Chancellor, the Governor and the Council were the Court of Appeals from the Chancery Court. Some of the members of Council were clerks of courts and yet they presided as judges of the Provincial Court on appeals from the county judges. All judges held their commissions at the Proprietary's pleasure. Surely this was not a free government nor fit for Englishmen. Such is a brief outline of his cogent argument. At the opening of the American Revolution Dr. Brooke warmly supported the patriotic side, was a member of Convention in July, 1775, and signed the well-known Association of the Freemen of Maryland.[14]

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[8] 26 Gent. Mag., 32.

[9] 22 Gent. Mag., 182.

[10] 22 Gent. Mag., 208.

[11] 22 Gent. Mag., 278.

[12] 51 Philosophical Transactions, 70.

[13] 33 Gent. Mag., 541.

These are but a few scattered notes concerning a useful man. He was the first known scientific observer in Maryland, the first medical man in the State to publish an account of his practice, and was one of the early physicians to be interested in politics, serving his State in public as well as in private ways, in which course he has had many successors down to the present day.

NOTES ON NEW BOOKS.

The Practical Study of Malaria and Other Blood Parasites. By J. W. W. STEPHENS, M. D., and S. R. CHRISTOPHERS, M. B., Members of the Royal Society's Commission on Malaria in Africa and India, 1898-1902. (*Published for the University Press of Liverpool, by Longmans, Green & Co., London, New York and Bombay. 1903.*)

The book is essentially a convenient epitome of the results of the recent studies of malaria and allied diseases which have led to the investigation in such extraordinary detail of protozoan animals and of the insects which act as their temporary hosts. As such it makes no pretense to literary merit, but is an excellent and extremely practical guide to the methods of investigation of these diseases which must be very valuable to those who go out to the tropics for their study. Elaborate apparatus is not recommended, the most simple expedients which frequently answer so well being described in each case—when it is a question of a bottle, it is the whiskey bottle—and in every case ordinary household utensils are made to do duty in order to avoid the transportation of much baggage.

The authors describe the technique of the examination of blood, then the blood itself, after which they turn to the life history of the malarial parasite and its effects on the blood and tissues. Sixteen chapters then follow upon the mosquitoes, their general life history, their eggs, larvæ, etc., modes of experimenting with them and of dissecting and studying their anatomy. The classification of the various genera and species, many of which are of such recent recognition, is followed by a minute description of the general nature, habits and anatomy of the forms of Anopheles which are so important in relation to malaria. Geographical and clinical studies of malaria, as well as of the Blackwater fever, receive some attention, and the last chapters are devoted to various other protozoan parasites, especially the trypanosomata and the filariæ.

There is some repetition, especially in the various descriptions of the life history of the malarial parasite and of the mosquitoes, and there is some obscurity as to the relations of each of these mosquitoes to the various types of the disease—an obscurity which must remain until cleared up by further work. On the whole, however, for the purpose intended the book seems an admirable one.

A Text-book of Operative Surgery. Covering the Surgical Anatomy and Operative Technic involved in the Operations of General Surgery. Written for students and practitioners. By WARREN STONE BICKHAM, Phar. M., M. D., Assistant Instructor in Operative Surgery, College of Physicians and Surgeons, New York; Late Visiting Surgeon to Charity Hospital, New Orleans, etc. Second revised edition. Octavo of 984 pages, with 559 illustrations. (*Philadelphia, New York, London. W. B. Saunders & Company, 1904.*)

The exhaustion of the first edition of this work and the demand for another edition are good indications of the popularity of the book. A notice of the first edition appeared in the BULLETIN for January of the present year. The second edition has not been essentially changed and the labor of the author has been restricted for the most part to the correction of typographical errors. The book is a very creditable specimen of book-making. It has an excellent index.

Obstetrics for Nurses. By JOSEPH B. DE LEE, M. D., Professor of Obstetrics in the Northwestern University Medical School, Chicago; Lecturer in the Nurses' Training Schools of Mercy, Wesley, Provident, Cook County, and Chicago Lying-in Hospitals. 12mo. of 460 pages, fully illustrated. (*Philadelphia, New York, London: W. B. Saunders & Company, 1904.*)

This book is designed to serve as a text-book of obstetrics for nurses, and as a guide in the care of obstetrical patients. It is well adapted for use as either. It is clearly and concisely written, well printed and unusually well illustrated. The obstetrical teaching is sound and the instructions for the care of the patient during pregnancy, labor and the puerperium are excellent.

Golden Rules of Anæsthesia. By R. J. PROBYN-WILLIAMS, M. D., Senior Anæsthetist and Instructor in at the London Hospital. Golden Rule Series, No. XIV. (*Bristol: John Wright & Co., London: Simpkin, Marshall, Hamilton, Kent Co., Lim.*)

This volume should be placed in the hands of every person who has occasion to administer an anæsthetic. The advice which it gives is concise and the principles taught are most valuable. It deserves careful study and consideration.

The Mattison Method in Morphinism. A Modern and Humane Treatment of the Morphin Disease. By J. B. MATTISON, M. D. (*Published for the Author. E. B. Treat & Company, New York.*)

This primer of 40 pages is a plea for the employment of the bromides in the treatment of morphia addiction. The author prefers to use the bromide of sodium, given twice in 24 hours, to secure the continuous presence of this drug in the patient's blood. He begins with initial doses of 10 grains of bromide of sodium and increases the amount given up to 100 grains twice in 24 hours. While he is thus increasing the dosage of the bromide of sodium he is constantly diminishing that of the usual opiate until the latter is wholly withdrawn on the tenth day. After the opiate has been discontinued he resorts to codein to treat the nervous symptoms, in doses of 1 to 2 grains every 3 to 5 hours. Like many other physicians connected with private sanitaria for habit cases, the author seems inclined to exaggerate the distress of persons who are suddenly deprived of morphia. A long experience with such cases leads the writer to think that the majority may be deprived of the drug at once and without any harm, provided they are carefully nursed and properly fed. Some exceptional cases may require to have the drug withdrawn gradually or another drug substituted for it. The patient who has usual physical vigor makes more rapid recovery and develops more strength of purpose and moral vigor if he is deprived of the pernicious drug at once.

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[14] 11 Md. Arch., 4, 67.

A System of Practical Surgery. By PROF. E. VON BERGMANN, PROF. P. VON BRUNS and PROF. J. VON MIKULICZ. Vol. II. Translated and edited by WILLIAM T. BULL, M. D., Professor of Surgery, Columbia University, and CARLTON P. FLINT, M. D., Instructor in Minor Surgery, Columbia University, New York. Surgery of the Neck, Thorax and Spinal Column.. (*New York and Philadelphia: Lea Brothers & Company, 1904.*)

Those who may have expected, from an American edition of Bergmann, Bruns and Mikulicz's well known "Handbuch der praktischen Chirurgie," what has been realized in the English translation of Nothnagel's System, for example, will be bitterly disappointed. The present surgical volume deals with the surgery of the neck, thorax and spinal column, and to the original chapters, not only has nothing of value been added, but they have lost much of their original character. The volume is published on heavy paper which, together with the insertion of some two dozen plates, brings its physical size and weight up to that of the German original. Two important chapters are missing—that by v. Hacker on the Œsophagus (104 pages) and another on the Pelvis by Steinthal (69 pages)—which may possibly appear in a later volume. The fact that they are not included in the present volume should have been explained.

One who is accustomed to using the German original misses greatly the German method of italicizing important words and sentences, also of putting the less essential, though pertinent, matters in smaller type. Regrettable above all is the omission of the bibliographical references which the authors of the various chapters in the original had carefully appended to their articles. Why this should have been done it is difficult to understand, as the references required no translation and would have taken, all told, but a few pages of the book, which now contains, including fragments at the ends of chapters, *twenty pages* of blank paper, for example, 92, 142, 366, 292, and 561, 562 and 563.

The illustrations also are deserving of serious criticism. There have been added to the book expensive and unnecessary colored plates, some twenty in number, which do not serve even to make the book superficially attractive. The anatomical plates borrowed from Spalteholtz, Testut, Joessel, etc., are absolutely inappropriate to a surgical work of this kind, and furthermore have lost their simple anatomical value as the structures in these reproductions are no longer carefully labeled as they were in the original. From Kocher's "Operationslehre" are also borrowed several plates; the one bad feature of that otherwise superior volume—its illustrations—having been taken to "grangerize" a volume in no sense an operative surgery. The legends under Figs. 140 and 141 are transposed.

Something of the individuality of the separate sections has been lost, for those unacquainted with the original, by the neglect in many instances of placing under the titles the names of the distinguished surgeons who are responsible for them.

The translation is only fairly well done. The arrangement of chapters and sections has not been strictly adhered to, and as a result a lack of proportion is noticeable in the various chapters. As examples, see Chapters XX and XXI, which are merely sections in the original.

The publishers have done their part excellently well. Printing, illustrations and paper are all most creditable. When publishers have made such a creditable effort to issue a standard book, it is to be regretted that the work of translation and editing has not received the same attention.

Intercolonial Medical Congress of Australasia. Transactions of the Sixth Session, held in Hobart, Tasmania, February, 1902. Published under the Direction of the Literary Committee By GREGORY SPROTT, M. D. (*Tasmania: John Nail, Government Printer, Hobart, 1903.*)

This volume of nearly 500 pages gives an interesting report of the work of the Australasian Intercolonial Medical Congress. Many of the papers are timely and full of interest, as, for example, "Notes on the Epidemic of Plague in Sydney," "Tropical Dysentery," the "Sanatorium Treatment of Consumption," and the series of papers on Cancer. They are well worth careful reading.

A Manual of Syphilis and the Venereal Diseases. By JAMES NEVINS HYDE, A. M., M. D., Rush Medical College, and FRANK HUGH MONTGOMERY, M. D., Rush Medical College, Chicago. Second edition, revised and enlarged. With 58 illustrations in the text and 19 full-page lithographic plates. (*Philadelphia: W. B. Saunders & Company, 1904.*)

This whole book is worthy of careful study on the part of the student and physician. Certain chapters, however, ought to be in the hands of every physician. The chapter entitled, "Syphilis, in relation with the family and society," contains so much sound sense and such careful instructions as to the duty of the physician to protect an innocent member of the household from an infected partner that it is worthy of special mention. The chapter on "Hypochondriasis" also treats judiciously of a condition which is frequently brought to the attention of all practitioners of medicine. The instruction which it contains is well calculated to benefit all who have to deal with the various forms of sexual hypochondria.

In the chapter on acute urethritis it is worthy of notice that the authors do not share the enthusiasm felt by many for the so-called "Janet method" of treating gonorrhœa. This seems to have been the experience of the vast majority of physicians who have attempted to treat this disorder by local treatment only.

The book is well written, excellently illustrated and attractively printed, and deserves a wide use.

International Clinics. A Quarterly of Illustrated Clinical Lectures and especially prepared Original Articles. Edited by A. O. J. KELLY, M. D. Vol. II, 14 Series. (*Philadelphia: J. B. Lippincott Company, 1904.*)

A considerable portion of this volume is taken up with the diseases of warm climates and there are a number of excellent articles. Dr. Mason, of the Army, writes on the spread of disease by insects, with special reference to prophylaxis. The article is illustrated by a number of plates to assist in the recognition of the various forms of mosquitos, and a number of excellent practical points are given. Dr. John McCrae, of Montreal, contributes an article on recent progress in tropical medicine and sums up much of the recent work. As might be expected, trypanosomiasis occupies a large space. Dr. Krauss, of Memphis, contributes an excellent article on malarial hæmoglobinuria. In reference to the treatment, Dr. Krauss lays emphasis on the fact that the prophylaxis of malaria will prevent blackwater fever, but when the attack has been precipitated quinine has no place in the therapy. There is a good article by Dr. Allen Smith on uncinariasis, and we are glad to see that in the treatment he advises giving larger doses of thymol than is usually done. He does not hesitate to give 90 grains in three doses. There are two articles on abscess of the liver. The first is by Dr. James Cantlie, of London. He notes some of the doubtful points in regard to the subject, and makes the statement that amœbæ coli are not present in the pus from a deep-seated suprahepatic abscess until the third day after operation. There is little doubt that if scrapings were taken from the wall of the abscess cavity at the time of the operation, amœbæ would usually be found. They are very rarely found in the pus at operation, although this rule is not without exceptions. The various operative procedures are described at length and especially the operation by the trochar and cannula, of which the operator speaks with favor. Dr. Thompson discusses the symptoms and the diagnosis rather more fully.

The second section deals especially with the treatment of various conditions of the vascular system. Dr. Bierring emphasizes the importance of the recognition of arterio-sclerosis of the gastro-intestinal vessels. There is one article on the use of digitalis in cardiac disease and one on chronic valvular disease which do not add especially to the sum of human knowledge. The remaining articles are of a miscellaneous character and do not require any special mention.

A Handbook of Ophthalmic Science and Practice. By Henry E. Juler, F. R. C. S., Ophthalmic Surgeon to St. Mary's Hospital; Consulting Surgeon to the Royal Westminster Ophthalmic Hospital; Consulting Ophthalmic Surgeon to the London Lock Hospitals. With illustrations. Third edition. Revised and enlarged. (*Philadelphia: Lea Brothers & Company, 1904.*)

This work has long held a high place in ophthalmic literature, and the last edition shows no falling away from the standard which was set by the first edition nearly twenty years ago. Like most English writers on medical subjects, the author gives us his own views and there is no wandering into foreign lands in search of precedent, or comparison of sanction for this or that opinion or method of treatment. He works out his own salvation in the great eye clinics of London. As a consequence we miss reference to some of the valuable contributions which have been made to ophthalmology by other than Englishmen. We note with satisfaction that interstitial keratitis is not uncommonly to be attributed to tuberculosis, a view which we have long upheld and one which finds strong supporters in von Hippel and others. We cannot, however, agree with him in his explanation of the cause of pannus, the origin of which he regards as entirely mechanical; in other words, as due to the irritation produced by either the rough granular lid or the incurved tarsus rubbing upon the cornea. It seems far more likely that pannus is due to a direct invasion of the cornea by the trachomatous process, and that we have pretty much the same process in the cornea as in the conjunctiva of the upper lid. The location of the pannus on the upper half of the cornea is due to the fact that that part of the cornea is in constant contact with probably the most highly infected part of the conjunctival surface, namely, with the conjunctiva of the upper lid, for in this location we usually have the most intense manifestations of the disease. In speaking of the treatment of trachoma nitrate of silver in the acute stage is given the first place, and properly so, we think, but it seems surprising that no mention is made of the other silver salts, particularly of protargol, which in 30 and 40 per cent solutions has been found by many more satisfactory than copper sulphate in the treatment of the later stages of the disease.

The work is generously illustrated with wood-cuts, half-tone plates and photomicrographs. There may be a suggestion of an insular origin in its therapeutics, but as it is the product of an experienced and distinguished ophthalmologist we can commend it cordially and wish it long life and prosperity.

Röntgen Ray Diagnosis and Therapy. By Carl Beck, M. D., Professor of Surgery in the New York Post-Graduate Medical School and Hospital. With 322 illustrations in the text. *New York and London: D. Appleton & Company, 1904.*)

The literature upon the application of the X-rays has become very extensive. In the past few years many contributions have been made.

In the preface of the present volume the author apparently thinks, however, that from the clinical standpoint the X-ray has been neglected and so says the object of his book is "to demonstrate how Röntgen rays can best be utilized in medical and surgical practice."

The book may be roughly divided into three sections. Section one, which is devoted to apparatus and X-ray technique, is much to be commended, as in it the author gives a very good and concise description of the various parts of an X-ray equipment. The reader is not burdened with useless details, but simply has before him the chief and salient points. The part of this section devoted to the X-ray tube is especially good.

The second section deals with the diagnostic value of the X-ray. In passing we may say that here the author attempts to introduce the words "Rontgograph" and "Rontgography," to replace radiograph and radiography. These latter terms, he says, are the words "constructed by violent word composers," and consequently should not be used. The old terms, however, are so well fixed that we need not fear the introduction of these new and cumbersome words.

This section is illustrated with a number of good radiographs. Those on fractures before and after treatment are especially good.

In this connection it seems to the reader that the author goes beyond the province of his subject in presenting the details of surgical treatment. The proper way to apply splints and plaster bandages to a fracture is surely foreign to a book on "Röntgen Diagnosis and Therapy."

In another place considerable space is devoted to the surgical procedures required in excising the head of the humerus for an old dislocation which had been recognized by means of a radiograph.

In this way much that is good is spoiled by compelling the reader to consider methods of treatment and purely surgical procedures. The majority of persons who wish such details of surgery prefer to consult a text-book on surgery and not one on "Röntgen Diagnosis and Therapy."

Section three is devoted to Therapy. In this part the various diseases amenable to the X-ray are discussed. The illustrations in this section are very good and well worth looking over.

The last two chapters are devoted to brief summaries of the methods of use and what has been accomplished with the Finsen ray and radium.

The Right to Life of the Unborn Child. A Controversy between Professor Hector Treus, M. D., Rev. R. van Oppenraay, D. D., S. J., and Th. M. Vlaming, M. D. (*New York: Joseph F. Wagner.*)

The purpose of this polemic is to justify the position of the Roman Catholic Church in regarding the life of the fœtus as of greater moment than the life of the mother. The view-point of the priest in this matter is so different from the physician's that a medical review of the discussion is scarcely possible.

The Practical Care of the Baby. By Theron Wendell Kilmer, M. D., Associate Professor of Diseases of Children in the New York School of Clinical Medicine. (*Philadelphia: F. A. Davis Company, 1903.*)

The book contains 150 pages, well printed on good paper. The illustrations are numerous, but chiefly consist of photographs of a doll arranged in various garments and held in different attitudes. The subject matter is the conventional care of the baby as already given by several books on the market, and it is difficult to see where there was a need for this volume.

A Treatise on Orthopedic Surgery. By Royal Whitman, M. D., Instructor in Orthopedic Surgery in the College of Physicians and Surgeons of Columbia University, New York. Second edition, revised and enlarged. Illustrated with 507 engravings. (*Philadelphia and New York: Lea Brothers & Company, 1903.*)

The first edition of Whitman's Orthopedic Surgery was so well received and has become so well known that little need be said about the second edition. The book has been revised, much new material and many illustrations added, and some of the chapters rewritten.

As might be supposed from the interest taken in the subject in this country last year, the chapter on Congenital Dislocation of the Hip has been enlarged and a more detailed description given of the Lorenz bloodless operation for the reduction of the hip. The author recommends that this operation be employed in all cases under 6 or 8 years of age, and that the open operation be performed when a cure has not been obtained.

The tuberculin test in the diagnosis of joint affections is mentioned only to be condemned on account of the frequency of tubercular glands, especially in children, causing a reaction when there is no disease in the joint. Evidently the local reaction has been overloked, or Dr. Whitman does not attribute the same importance to it as do some others.

The subject of orthopedics has been admirably treated by the author and the ground has been thoroughly covered, the latest methods being embodied in this book. References have also been given to the more important literature.

The general arrangement of the book is excellent. The subject headings are in heavy black type and paragraphs on differential diagnosis, and recapitulations, so important to the student, are frequent.

Nearly all of the appliances for treatment of orthopedic conditions are carefully described and well illustrated, the author giving the advantages and disadvantages of the different methods of treatment of the same condition at different stages of the disease, and, what is always important, telling what method he employs, and why he prefers it to others.

The book can be most highly recommended to those interested in orthopedics.

The Practical Medicine Series of Year Books. Comprising 10 Volumes on the Year's Progress in Medicine and Surgery. Under the General Editorial Charge of Gustavus P. Head, M. D., Professor of Laryngology and Rhinology, Chicago Post-Graduate Medical School. Vol. III. The Eye, Ear, Nose and Throat. Edited by Drs. Casey A. Wood, Albert H. Andrews and Gustavus P. Head. (*Chicago: The Year Book Publishers, December, 1903.*)

This is the third series of these year books, and the high standard presented in former years has been maintained. The abstracts of important papers are fairly complete and satisfactory. The one criticism we would make of this volume is that we believe the section devoted to diseases of the ear is incomplete. There are only six references in this department to articles appearing in foreign journals, and even some of the American publications have been entirely ignored. Most of the journals which we have in mind should have been at the command of the reviewer and it is hardly reasonable to suppose that none of them contained articles worthy of consideration.

H. O. R.

Diseases of the Eye. By L. Webster Fox, A. M., M. D., Professor of Ophthalmology in the Medico-Chirurgical College of Philadelphia, Pa.; Ophthalmic Surgeon in the Medico-Chirurgical Hospital. With 5 colored plates and 296 illustrations in the text. (*New York and London: D. Appleton & Company, 1904.*)

Perhaps every book that is published contains some measure of good and the reviewer is generally pleased if this be sufficient to afford an opportunity to praise the author and his work, but there are many instances where this element of praiseworthy work is so small, as compared with the poor quality of the balance, that the whole effort falls under the ban of criticism. It would seem to us that this is one of the occasions when the book under consideration deserves condemnation rather than praise. It contains nothing that is particularly new and nothing that is not expressed far better in any one of three or four existing American text-books on Ophthalmology. The few new features that are introduced as the work of the author present little of originality, for they are practically all adaptations of or modifications of the work of others. We are even disappointed in the illustrations. The five colored plates are very good, two of them representing the high class work for which Miss Washington has become noted, but fully one-half of the text illustrations are simply duplicates of those used in the American edition of Fuchs and another large percentage are reprinted from Norris and Oliver's System.

From the preface we learn that treatise was prepared especially for the use of students of medicine, and are told that "the author has aimed at simplicity of diction in an effort to present to them, in language they can comprehend, the principles which underlie the normal as well as the pathological changes that take place in the eye and its appendages; " and yet, in the course of the work, so many high sounding and rarely used words are employed that it is necessary to append an eight-page glossary.

From the same source we ascertain that the book expresses "the author's own views of pathology and methods of treatment." In regard to the question of pathology, we feel quite sure that no one will dispute the claim; it is weak throughout and woefully out of date in some particulars.

The publisher's part of the work has been very satisfactorily performed, and we sincerely regret that we cannot say as much of the labors of the author.

H. O. R.

Normal Histology. A Manual for Students and Practitioners. By John R. Wathen, A. M., M. D., Professor of Surgery and Gynecology, formerly Professor of Histology and Pathology, Kentucky School of Medicine, Louisville, Ky. 12mo, 220 pages, 114 illustrations. (*Philadelphia and New York: Lea Brothers & Company, 1903.*)

This book is designed to replace the popular Quiz Compend, and its arrangement is certainly much superior to that of the Compend. It commences with a chapter on the cell, takes up the various tissues and organs successively, includes a short chapter on embryology and ends with one on histological technique. Each chapter in a brief, clear description gives a short summary of the organ or tissue described, and has appended to it a set of questions to facilitate review.

The arrangement is a good one, but necessarily in so brief a work completeness and accuracy are subservient to brevity and disputed points are sometimes treated rather dogmatically. For example, "endothelium, including the linings of the lymphatics, blood vessels and serous cavities, are classified with epithelium on account of its morphological resemblance to squamous epithelium, but more properly belongs with the connective tissues as it owes its origin to the same layer of the blastoderm"—a point as yet unsettled. And the spleen is considered of greater importance than the bone marrow in the formation of the leucocytes of the blood. However, such examples are not frequent and much information is crowded into a small space.

The illustrations are chosen with good judgment from other works, but are rather poorly reproduced.

The book should be useful to those who are taking a short course in histology or who wish to review the subject rapidly and have not the time to study one of the larger and more complete works on histology.

BOOKS RECEIVED.

A Manual of Clinical Diagnosis. By Means of Microscopical and Chemical Methods. For Students, Hospital Physicians and Practitioners. By Charles E. Simon, M. D. Fifth edition, thoroughly revised and enlarged. Illustrated with 150 engravings and 22 plates in colors. 1904. 8vo. 695 pages. Lea Brothers & Co., Philadelphia and New York.

The Medical Annual. A Year Book of Treatment and Practitioner's Index. 1904. Twenty-second year. 12mo. 999 pages. John Wright & Co., Bristol; Simpkin, Marshall, Hamilton, Kent & Co., London.

Golden Rules of Dental Surgery. By Charles W. Glassington, M. R. C. S., L. D. S. ED. "Golden Rules" Series No. XIII. 32mo. 69 pages. John Wright & Co., Bristol; Simpkin, Marshall, Hamilton, Kent & Co., London.

Saint Bartholomew's Hospital Reports. Edited by A. E. Garrod, M. D., and W. McAdam Eccles, M. S., F. R. C. S. Volume XXXIX. 1903. 8vo. 211 pages. 1904. Smith, Elder & Co., London.

Obstetrics for Nurses. By Joseph B. De Lee, M. D. Fully illustrated. 1904. 12mo. 460 pages. W. B. Saunders & Company, Philadelphia, New York, London.

Manual of Clinical Microscopy and Chemistry. Prepared for the Use of Students and Practitioners of Medicine. By Dr. Hermann Lenhartz. Authorized translation from the fourth and last German edition, with notes and additions, by Henry T. Brooks, M. D. With 148 illustrations in the text and 9 colored plates. 1904. 8vo. Pages XXVIII + 412. F. A. Davis Company, Philadelphia.

Scientific Memoirs. By the Officers of the Medical and Sanitary Departments of the Government of India. (New Series.) No. 6. *First Report of the Anti-Malarial Operations at Mian Mir, 1901-1903.* By Captain S. P. James, M.B. (Lond.), I.M.S. Issued under the Authority of the Government of India, by the Sanitary Commissioner with the Government of India, Simla. 1903. 4to. 53 pages. Office of the Superintendent of Government Printing, Calcutta.

A Text-Book of Physiology. By Isaac Ott, A. M., M. D. With 137 Illustrations. 1904. 8vo. 563 pages. F. A. Davis Company, Philadelphia.

Treatise on Diseases of the Skin. For the Use of Advanced Students and Practitioners. By Henry W. Stelwagon, M. D., Ph. D. Third edition. With 220 illustrations in the text, and 26 full-page lithographic and half-tone plates. 1904. 8vo. 1115 pages. W. B. Saunders & Company, Philadelphia, New York, London.

Atlas and Epitome of Operative Gynecology. By Dr. Oskar Schaeffer. Authorized translation from the German with editorial notes and additions. Edited by J. Clarence Webster, M. D. (Edin.), F. R. C. P. E., F. R. S. E. With 42 colored lithographic plates and many text-illustrations, some in colors 1904. 12mo. 138 pages. W. B. Saunders & Company, Philadelphia, New York, London.

Burdett's Hospital and Charities. 1904. Being the Year Book of Philanthropy and the Hospital Annual. By Sir Henry Burdett, K. C. B. 12mo. 1122 pages. The Scientific Press (Limited), London.

Bulletin of Iowa Institutions (Under the Board of Control). Published quarterly. Volume V. 1903. 8vo. 564 pages. 1904. Franklin Printing Co., Des Moines.

The Worth of Words. By Dr. Ralcy Husted Bell. With an introduction by Dr. William Colby Cooper. Third edition, revised and enlarged. [1904] 12mo. 307 pages. Hinds and Noble, New York.

The Man Who Pleases and the Woman Who Charms. By John A. Cone. [1904.] 16mo. 131 pages. Hinds and Noble, New York.

Howe's Handbook of Parliamentary Usage. Arranged for the Instant Use of Legislative and Mass Meetings, Clubs and Fraternal Orders, Teachers, Students, Workingmen. By Frank William Howe. 1904. 16mo. 54 pages. Hinds and Noble, New York.

Traité de Radiologie Médicale. Publié sous la direction de Ch. Bouchard. Avec 356 figures et 7 planches hors-texte. 1904. 8vo. 1100 pages. G. Steinheil, Paris.

The Practical Study of Malaria and Other Blood Parasites. By J. W. W. Stephens, M. D. Cantab., D. P. H., and S. R Christophers, M. B. Vict., I. M. S. 1903. 8vo. XXXV + 378 pages. Longmans, Green & Co., London, New York and Bombay.

A System of Practical Surgery. By Prof. E. von Bergmann, M. D., Prof. P. von Bruns, M. D. and Prof. J. von Mikulicz, M. D. *Volume I. Surgery of the Head.* Translated and Edited by William T. Bull, M. D., and Walton Martin, M. D. 1904. 8vo. 936 pages. Lea Brothers & Co., New York and Philadelphia.

A System of Practical Surgery. By Prof. E. von Bergmann, M. D., Prof. P. von Bruns, M. D., and Prof. J. von Mikulicz, M. D. Volume II. Translated and edited by William T. Bull, M. D., and Carlton P. Flint, M. D. *Surgery of the Neck, Thorax and Spinal Column.* 1904. 8vo. 820 pages. Lea Brothers & Co., New York and Philadelphia.

International Clinics. A Quarterly of Illustrated Clinical Lectures and Especially Prepared Original Articles on Treatment, Medicine, Surgery, Neurology, [etc.] Edited by A. O. J. Kelly, A. M., M. D. Volume I. Fourteenth Series. 1904. 8vo. 304 pages. J. B. Lippincott Company, Philadelphia.

Éléments de Pathologie et de Clinique Chirurgicales. Par le Dr. Léon Moynac. Huitième édition. Three volumes. 1903. 12mo. G. Steinheil, Paris.

Manuel de Pathologie Générale et de Diagnostic. Par le Dr. Léon Moynac. Sixième édition, revue et considérablement augmentée par Constant Hillemand. Two volumes. 1903-04. 12mo. G. Steinheil, Paris.

A System of Physiologic Therapeutics. A Practical Exposition of the Methods, Other than Drug-Giving, Useful for the Prevention of Disease and in the Treatment of the Sick. Edited by Solomon Solis Cohen, A. M., M. D. Volume VII.

Mechanotherapy and Physical Education, Including Massage and Exercise. By John K. Mitchell, M. D., and *Physical Education by Muscular Exercise.* By Luther Halsey Gulick, M. D. With 229 illustrations. 1904. 8vo. 420 pages. P. Blackiston's Son & Co., Philadelphia.

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ON THE CAUSES OF CARDIAC INSUFFICIENCY.[1]

By JOSEPH H. PRATT, M. D.

Physician to Out-Patients, Massachusetts General Hospital; Fellow of the Rockefeller Institute for Medical Research.

Bamberger[2] was the first to recognize that true cardiac insufficiency is a muscle insufficiency. It is an inability of the heart muscle to do its work. Cardiac insufficiency is, of course, not synonymous with valvular insufficiency. The healthy cardiac muscle by doing extra work, usually compensates for the regurgitation caused by a leaky valve.

The work done by the heart is determined by the quantity of blood which enters the heart during diastole and the amount of resistance to be overcome in forcing the blood into the arteries. Pathological conditions can only affect the work of the heart by altering the resistance of the diastolic blood-quantum.

In cardiac insufficiency there is a disproportion between the heart's capacity for work and the amount to be done. It does not matter whether the working power of the heart be diminished so that it is unable to meet normal demands or whether the demands made upon a healthy heart are so increased that its functional capacity is inadequate. In either case cardiac insufficiency is the result.

The cardiac incompetency is due either to the inability of the heart to dilate sufficiently to receive all the blood that flows from the veins, or the inability to propel the blood through the arteries with proper velocity. Hence the fault lies either in a diminution of the heart's power of contraction or its power of dilatation.

If the weakness affects chiefly the left ventricle,[3] less blood will be thrown at each systole into the aorta. The arteries will be but scantily filled and hence there will be a diminution in the size of the pulse and a fall of arterial blood pressure. The feeble ventricle will contain at the end of systole the blood it was unable to eject into the aorta and this will prove a hindrance to the entrance of blood from the left auricle during diastole. The left auricle will become distended, and congestion of the pulmonary vessels will result.

If the right heart is able to overcome the increased resistance, the blood pressure in the lung will be abnormally high. The right ventricle will eject no more blood than the left ventricle, because it receives no more. The circulation of the blood is slowed, the distribution altered and the lungs overfilled. If the right heart weakens then the blood will collect in the right auricle and venous trunks, and if the incompentency is marked chronic passive congestion of all the abdominal organs will ensue. With weakness of the right ventricle the arteries of the systemic circulation are, as a rule, less well filled than normally and the blood pressure is low, even if the left heart is relatively strong. This is easily explained, the left heart receives less blood during diastole and hence the amount injected during systole must be diminished. Usually cardiac insufficiency affects both ventricles.

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[1] A lecture delivered in the course for graduates at the Johns Hopkins Medical School.

[2] Bamberger: Lehrbuch der Krankheiten des Herzens. Vienna, 1857, p. 313.

[3] Compare Cohnheim, Lectures on General Pathology. Trans. by McKee, London, 1889, 1. p. 78, v. Basch, Allgemeine Physiologie und Pathologie des Kreislaufs, Vienna, 1892, p. 103. Krehl, Pathologische Physiologie, Leipsic, 1898, p. 64. Moritz, Deutsches Archiv für klin. Med., 1899, LXVI, p. 349. Lazarus-Barlow, Manual of General Pathology, 2nd edit., London, 1904, p. 77.

If the heart does not contract completely there will remain at the end of systole an increased amount of blood in the ventricle. This, added to the blood entering the heart during the next diastole, distends the cavity and the condition is spoken of as dilatation. There are all degrees of cardiac insufficiency from the slight disturbances of function, only apparent after severe muscular efforts, to completely broken compensation.

In many cases of acute and chronic disease the issue between life and death rests with the heart. Speaking of pneumonia in the aged, Huchard says "*La maladie est au poumon, le danger est au coeur.*"

The condition of the heart muscle determines the clinical course of chronic valvular disease. The cause of the great variations in the clinical pictures depends less on the valvular defect than on the condition of the cardiac muscle. The nature and severity of the valvular lesion alone will not explain the circulatory disturbances. A patient with marked mitral insufficiency as determined by physical examination may be able to climb a high flight of stairs or do considerable work without becoming short of breath. Another patient with a less degree of the same valvular lesion may not be able to take a dozen steps and be quite incapable of doing any bodily work.[4]

The contraction of the cardiac muscle cannot be compared to that of the biceps. As Martius[5] says the heart is not a hollow muscle but a hollow muscular organ. It works continuously and it does not become exhausted. With each systole it does .2 to .8 kgm. of work, and according to Zuntz[6] drives forward sixty cubic cc. of blood and maintains an arterial blood pressure of about 160 mm. of mercury. The work done by the heart in a day amounts to about 75,000 kilogrammemeters, which Foster[7] estimates is just about the amount of work done in the ascent of Snowden by a tolerably heavy man.

The work of the heart at each beat may be increased in two ways. Either it has to pump more blood than usual or the resistance to the cardiac contraction is augmented. If an increased amount of blood enters the heart at each diastole more blood than normal must be forced out at each systole and, unless the frequency of the beats is diminished or the time of contraction increased, the heart must do more work. Experiments show that when the heart is unusually distended during diastole the frequency of the systolic contractions is not changed and hence the muscle fibres must contract more vigorously.[8] The reserve-power of the heart is enormous and so it meets the extra demands with ease. Lewy[9] has shown that the heart exerted to its maximum is capable of doing thirteen times as much work as it does when the body is at rest. By stimulating the vagus the diastole is prolonged and the heart becomes greatly distended with blood. Stolnikow[10] found that the next systole following stimulation of the vagus was able to propel more than six times the usual amount of blood. Also by pressure on the abdomen and by other means, the heart can be greatly distended with the same result. The pulse rate is not disturbed, the contraction of the heart is simply more powerful. This adjustment of the heart to varying quantities of the blood takes place so quickly that v. Frey maintains it cannot be due to reflex action. We know little in regard to the influence of the vagus, the accelerans, or the cardiac ganglion cells in the production of disturbances of cardiac function, and the significance of anatomical alterations in these structures is not understood. The researches of His[11] and Romberg[12] have shown that the ganglion cells are sensory, not motor in nature. It was demonstrated many years ago that if the nerves which pass to the heart were severed the power of accommodation was still preserved. This regulatory mechanism probably resides in the muscle fibres. There is no evidence to show that the cardiac muscle fibres do not work automatically,[13] and it may be that the greater stretching of the muscle fibres by the distention of the wall enables them to contract more vigorously.[14] Martin[15] showed twenty years ago that the mammalian heart removed from the body would beat for hours in a normal manner.

As the working power of the heart is dependent on the contractility of the muscle fibres and the elasticity of the heart wall, any cause which diminishes the contractility and the elasticity will tend to produce cardiac insufficiency. We shall now consider in some detail the anatomical alteration of the heart muscle which has generally been thought to be the most common cause of cardiac weakness, and that is fatty metamorphosis. The term fatty heart embraces two entirely distinct anatomical conditions. It refers both to an increase of adipose tissue between the heart fibres, and to a deposit of fat droplets within the muscle cells. The former condition is usually called fatty overgrowth or fatty infiltration, and the latter fatty degeneration.

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[4] Vide Krehl: Deutsches Archiv f. klin. Med., 1890, XLVI, p. 454.

[5] Martius: Volkmann's Sammlung klinische Vorträge, 1894, No. 113, p. 192.

[6] Zuntz: Deutsche med. Woch., 1892, p. 109.

[7] Foster: A Text-book of Physiology, sixth edition. London, 1893, Part 1, p. 268.

[8] v. Frey: Deutsches Arch. f. klin. Med., 1890, XLVI, p. 398. Krehl: Pathologische Physiologie, Leipsic, 1898, p. 5.

[9] Lewy: Zeit. für klin. Med., 1896, XXXI, p. 321.

[10] Stolnikow: Du Bois' Archiv für Physiologie, 1886, p. 1.

[11] His: Verhandlungen des IX Congress für innere Medicin. Wiesbaden, 1890, p. 367.

[12] Romberg: Ibid, p. 356.

[13] Engelmann: Pflüger's Archiv, 1897, CLXV, p. 535. Engelmann: Die Deutsche Klinik, Berlin, 1903, IV, p. 215. Gaskell: Schäfer's Text-book of Physiology, London, 1900, II, p. 169.

[14] This is the view of v. Frey and Krehl. Roy and Adami showed (Phil. Trans. Roy. Soc., London, 1892, CLXXXVIII, p. 213) that distention increases the resistance to contraction.

[15] Martin: Studies from the Biological Laboratory of the Johns Hopkins University, 1883, II, p. 119.

The fatty metamorphosis is regarded by many authorities as a most serious alteration in the structure of the heart. Broadbent[16] states that "no form of heart disease is regarded with so much apprehension as fatty degeneration. And when the diagnosis has once been made prognosis for the most part can contemplate only one result; the fatal termination is merely a question of time and circumstance." Gibson[17] who devotes much space to its consideration asserts that fatty degeneration of the heart is the most common cause of sudden death. Many American writers express similar opinions.[18]

It appears that Harvey in the seventeenth century published the first observation on fatty heart. Upon dissecting the body of a very corpulent man he found the heart completely covered with fat, "*Cor adipe plane tectum.*"

Both varieties of fatty heart were recognized by Corvisart[19] and differentiated and described by Laennec[20] but we owe the first careful anatomical study of this condition to the English pathologists, especially Quain,[21] and to Rokitansky.[22]

One of the first recorded cases of fatty degeneration was that studied by John Cheyne[23] in 1818. At that time fatty degeneration of the heart was regarded as very rare. Corvisart,[24] stated that he had never seen a case. Cheyne's paper appeared in the second volume of the Dublin Hospital Reports. The case is of historical interest not only as being probably the first carefully recorded instance of fatty metamorphosis of the heart but also the first case in which the peculiar modification of respiration, now known as the Cheyne-Stokes was described. This type of breathing was thought by Stokes to be almost pathognomonic of fatty heart. The patient was sixty years of age. His pulse was irregular and unequal. There was œdema of the ankles in the evening. He had one attack of unconsciousness not followed by paralysis, but shortly before his death he became hemiplegic. At autopsy the brain showed merely congestion. The note on the heart was as follows: "The lower part of the right ventricle was converted into a soft fatty substance. The upper part was remarkably thin, and it gradually degenerated into this soft, fatty condition. The cavity of the left ventricle was greatly enlarged, and its whole substance with the exception of the internal reticulated structure and carneæ columnæ was converted into fat. The valves were sound, and the aorta studded with steatomatous and earthy concretions." No mention was made of the coronary arteries.

Later Robert Adams[25] published a case which Stokes said furnished the key to the diagnosis of this condition. This report like the one I have just quoted is of unusual interest, because it contains the first account of the Stokes-Adams syndrome. That, you remember, is the association of a persistently slow pulse with attacks of unconsciousness. The patient's age was sixty eight. The heart was very fatty, the condition of the coronary arteries is not described but the statement is made that "the coats of the carotid and middle arteries of the dura mater were quite white and opaque from bony deposits."

Rokitansky studied fatty metamorphosis of the heart microscopically and stated that the fat occurred as minute globules imbedded within the muscle among the primitive fibres, the transverse striæ of which were lost.

The conception that the cell proteids degenerated into fat dates from Virchow's article published in the first volume of his Archiv.[26] Two forms of fatty alterations of the parenchymatous tissues were recognized. Fatty infiltration in which the fat was deposited in the cells, and fatty degeneration of the cells. It was known that fat brought by the blood was normally taken up and deposited in the cells of the liver and in the connective tissue cells, especially those of the subcutaneous and subserous tissues. This was described as physiological fatty infiltration. If fat were deposited in great excess in these structures, for example in the liver, or if it were deposited in connective tissues, which normally contained little or no fat, it was spoken of as pathological fatty infiltration. When fat appeared in cells in which it was not normally demonstrable by microscopic methods, as those of the heart and kidney it was regarded as a fatty degeneration. It was taught that the diagnosis could be made histologically. In fatty degeneration it was held that the fat appeared in minute droplets which did not tend to become confluent, while in fatty infiltration the drops coalesced and pushed the nucleus to one side. This histological distinction was admitted not to be applicable to all cases. The fatty change in the kidney was regarded as a degeneration although the fat appears not only as minute granules but as large drops. Hansemann,[27] however, within the last few years came to the conclusion that fatty infiltration of the kidney could occur. The fatty liver resulting from phosphorous poisoning was regarded as a typical example of fatty degeneration and yet the fat appeared in the form of large as well as small drops.

The fatty degeneration was regarded as a very serious alteration in the cell. According to A. Fraenkel,[28] there was first a kind of necrobiosis of the cells, and that the cell proteids were split into a nitrogenous and non-nitrogenous moiety, and from the non-nitrogenous moiety fat was formed. It was but natural to assume that the function of a heart, the seat of such a destructive process, must be seriously impaired.

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[16] Broadbent: Heart Disease. New York, 1897, p. 282.

[17] Gibson: Diseases of the Heart and Aorta. Edinburgh, 1898, p. 649.

[18] Forchheimer: Trans. Assoc. Am. Phys., 1888, III, p. 89. Robinson: Am. Jour. Med. Sci., 1901, CXXI, p. 151. Anders: Ibid., 1901, CXXI, p. 429. Babcock: Diseases of the Heart and Arterial System, New York, 1903, p. 518. Warthin: Wood's Reference Handbook of the Medical Sciences, New York, 1902, IV, p. 589. Satterthwaite. Medical News, 1901, LXXVIII, p. 165.

[19] Corvisart: An Essay on the Organic Diseases and Lesions of the Heart and Great Vessels. Trans by Gates. Boston, 1812, p. 153.

[20] Laennec: A Treatise on Diseases of the Chest. Trans. by Forbes, 1838, p. 682.

[21] Quain: Med. Chir. Trans. London, 1850, XXXIII, p. 121.

[22] Rokitansky: A Manual of Pathological Anatomy. London, 1852, IV, p. 204.

[23] Cheyne: Dublin Hospital Reports, 1818, II, p. 221.

[24] Corvisart: Loc. cit., p. 154.

[25] Adams: Dublin Hospital Reports, 1827, IV, p. 353.

[26] Virchow: Virchow's Archiv, 1847, I, p. 94.

[27] Hansemann: Virchow's Archiv, 1897, CXLVIII, p. 355.

[28] Fraenkel: Virchow's Archiv, 1876, LXVII, p. 273.

It appears that the idea of Virchow that the proteids of diseased cells become converted into fat was accepted without much question, although no proof was adduced. Later it was supported by the experiments of Voit who claimed that animals fed on a pure meat diet took on fat. He concluded that nearly all the body fats were formed from proteids. Pflueger later showed that there where errors in Voit's analyses and that the conclusions were unwarranted.

There have been two periods, as Fischler[29] points out, in which especial interest has been manifest in regard to the significance of fat in its relation to pathological processes.

The first of these periods was in the middle of the last century, and dated from the appearance of Virchow's paper. Following the publication of Virchow's views a great deal was written on fatty degeneration, but very little original work was done.

The second epoch began in 1897, with the report made by Georg Rosenfeld,[30] of Breslau, at the German Congress of Internal Medicine. Pflueger had previously showed that the fat formed in the ripening of cheese and in adipocere was due solely to the action of bacteria, and hence was not analogous to the formation of fats in the living animal body. It was known that if a dog were starved for a number of days and then given phloridzin that the liver would be found extremely fatty. Now, if this fat, said Rosenfeld, which may amount to 75 per cent. of the weight of the dried liver, is formed from the cell proteids, as the pathologists teach, a great part of the cell proteids must be destroyed in the production of this amount of fat. But he found by examination that very little proteid had been lost, hence the fat must have been introduced from without. This explanation is supported by the fact that the blood of animals poisoned by phloridzin is rich in fat. The cells of the liver show no signs of degeneration and if the dog is starved again after the administration of phloridzin the fat disappears and the organ takes on its normal appearance. He demonstrated that the fat was brought from the subcutaneous tissues and paraperitoneal spaces by the following experiment. A dog was deprived of its fat by long starvation and then fed with a large amount of mutton suet. In the ordinary fat depots including the liver, mutton suet was found deposited. A few days without food, however, caused the fat to disappear from the liver, as was shown by control animals. Now animals thus treated had fat depots loaded with mutton suet, but livers free from fat. If Rosenfeld's view were correct the administration of phloridzin would cause mutton suet to wander from the fat depots to the liver and a mutton suet liver would result, and thus it proved; the animals so treated had 50 per cent. of mutton suet in the liver.

As we have said, the typical example of fatty degeneration of the liver cited by pathologists is that seen in phosphorous poisoning. If the fat is formed from the cell proteid, Rosenfeld reasons it will make no difference whether the fat store-houses are rich in fat or not, but if on the other hand the fat is brought to the liver from the fat store-houses, there can be no fat liver if the fat depots contain only a scanty supply of fat. And this is what he found. Very lean dogs poisoned with phosphorus did not exhibit fatty livers while in well nourished dogs the fat liver appeared. Dogs whose fat deposits were filled with mutton suet were given phosphorus and starved. When killed the livers were markedly fatty but the fat was mutton suet. Rosenfeld also showed that the fat in milk was not formed from the proteids in the mammary gland but was derived from fat which was brought from the fat store-houses to the breast.

Others[31] have confirmed and amplified the work of Rosenfeld. Many physiologists look upon the formation of fats from proteids not only as unproved but as improbable. Some believe that it may occur, although they do not regard it as an important mode of origin. It was known that the mammary gland and liver were concerned in the metabolism of fat, but it was different with organs such as the heart which do not store up fat normally. It did not follow from Rosenfeld's experiments that fat in the heart was not derived from a degeneration of its protoplasm. Rosenfeld in 1901,[32] however, and Leick and Winckler in 1902,[33] found that the fatty degenerated hearts of dogs which had been fed on mutton suet and then poisoned with phosphorus contained a fat identical with mutton suet. This proves that the so-called fatty degeneration of the heart is really another example of fatty infiltration.

The work of these investigators is important in regard to the clinical significance of fatty heart. So long as it was thought that the fat in the muscle cell was formed from the cell proteids it seemed as if the function of the cell must be seriously disturbed, although clinical observations, as we shall see, did not support this view. But if the fat is simply deposited in the cell it is different. We know that the protoplasm of the liver cells can appear microscopically to be almost entirely replaced by fat, and yet the functions of the organ be slightly if at all disturbed. The fatty liver of chronic alcoholism is an example of this. It has been shown that the fatty lesion is not due to a deficient supply of oxygen to the cells as was formerly held. It is possible that the fat is deposited in cells injured by the action of toxins. The fat may wander into the degenerated protoplasm of the heart muscle to fill up a vacant space just as connective tissue will grow into an area of necrosis and replace the destroyed cells. Leick and Winckler also suggest another possibility. The fat does not become visible in the healthy heart muscle because as fast as it is taken up by the protoplasm it is used to supply energy to the cell. The cardiac muscle takes up no more than is needed for immediate use, but a damaged cell may not be able to use the fat which it ingests in normal amount and hence the fat accumulates in the cell and becomes visible. Or possibly the fat enters the injured cell more readily and in larger amount. The fat in a cell occurs as free fat and as fat combined with protein. The combined fat is not visible. Taylor,[34] found that in fatty degeneration the combined fats were diminished and it may be that the fat visible in the muscle fibres of the heart is formed in part from the combined fat by autolysis. On this point, however, we have no exact information. Tissues which are microscopically fat-free and appear normal have been found on chemical analysis to contain as much as 20 per cent fat. On the other hand a pathological kidney with a slight content of fat can appear markedly fatty on microscopical examination.[35] There is evidence to show that fat is not deposited in dead cells.[36] Fat in a cell, Rosenfeld says, is a sign of life, not of death. Hester[37] and Hagemeister,[38] believe that disturbances of circulation bring an increased amount of fluids containing split fats, and these within the cell by a synthetic process are converted into neutral fats.

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[29] Fischler: Virchow's Archiv, 1902, CLXX, p. 100.

[30] Rosenfeld: Verhand. des XVI Congr. für inn. Med., Wiesbaden, 1897, p. 427.

[31] Kraus und Sommer: Hofmeister's Beiträge, 1902, II, p. 86. Leick und Winckler: Arch. für exp. Path. u. Pharm., 1902, XLVIII, p. 163. Rosenfeld: Ergebnisse der Physiologie, Wiesbaden, 1902, I, p. 651. Ibid., 1903, II, p. 50. Herxheimer: Erbegnisse der allgemeine Pathologie, Wiesbaden, 1904, p. 625. Kraus Cent. f. allg. Path., 1904, XV, p. 41.

[32] Rosenfeld: Cent. f. inn. Med., 1901, p. 145.

[33] Leick und Winckler: Loc. cit.

We can conclude from the result of this recent work that although the formation of fats from proteids in the animal body cannot be denied it has not been proved.

We will now inquire into the frequency, location, and amount of visible fat in the heart.

The frequency with which the heart muscle cells are the seat of fatty metamorphosis is not generally recognized. Dr. Osler[39] states that it is a common condition, but the majority of clinical writers imply that it is rather rare except in chronic heart disease and in severe anæmia and intoxications. It was a routine procedure for several years in Dr. Councilman's laboratory to examine a fresh specimen of the heart muscle for fat at every autopsy. My interest in the subject was aroused, not only by the frequent occurrence of marked fatty degeneration but also because no relation seemed to exist between fatty heart and cardiac weakness. We found that extreme fatty metamorphosis could be present without producing symptoms and in some cases in which cardiac weakness had been prominent the myocardium contained little or no fat. Osler[40] says in his text-book that extreme fatty changes, as in pernicious anæmia may be consistent with a full regular pulse, and a regularly acting heart. In some of these cases the fat does not appear to interfere seriously with the function of the organ.

Until the microscope came into use fatty degeneration of the heart was regarded as rather uncommon. You recall the traditional description of the heart, the seat of fatty degeneration. It is stated to be soft and flabby, with dilated cavities and of a pale yellow color. The endocardium, especially over the papillary muscles often presents a mottled appearance compared to a faded leaf, a tiger lily or a thrush's breast. The heart of pernicious anæmia usually answers to this description exactly. Our routine examinations showed, however, that a heart might be the seat of extensive fatty degeneration, and yet be firm, contracted, and of normal color, and without mottling of the subendocardial layer. The consistence depends largely on whether the heart stopped in systole or diastole and on the presence or absence of rigor mortis, while the yellowish hue is due in good part to the associated anæmia. And if the fat is uniformly distributed throughout the muscle the mottling which is caused by the localized deposition of fat will not appear. A heart which contains very little blood but no fat has a yellowish hue and may easily be mistaken for a fatty heart. Wagner called attention to this source of error.

Nearly all the well-known treatises on heart disease contain the statement that fatty degeneration is frequent in the hypertrophied hearts of chronic valvular disease and in myocarditis. And they lay emphasis upon its importance in the causation of disturbances of compensation. Wagner said that fatty degeneration is found in one-third of the cases of valvular disease. More recent writers (v. Recklinghausen, Zenker, and Krehl[41]), assert that fatty degeneration is rare in chronic heart disease and Bollinger came to the same conclusion in regard to the cases of cardiac weakness occurring among the Munich beer drinkers.

Very few observers have determined carefully the amount of fat present. The diagnosis has been made as we have said, either on the naked eye appearances or by examining microscopically one portion of the heart wall. The amount of fat present can be estimated either by a quantitative analysis or by a microscopic examination of all parts of the heart. Krehl adopted the chemical method; he removed the adipose tissue from the surface and substance of the heart and determined the quantity of fat in the entire organ. The dried substance of the normal heart contains about 8 per cent of fat. Only in phosphorus poisoning was marked increase of fat constantly found. In this condition about 25 per cent of the organ was converted into fat. In pernicious anæmia there was an average of 13 per cent found; a larger percentage than was present in any other disease except phosphorus poisoning. But there was no relation to be traced between the cardiac disturbance and the amount of fat present. The heart containing the largest quantity of fat had exhibited no signs of weakness while in another case in which there was dilatation of both ventricles, a systolic mitral murmur, and accentuated second pulmonic sound, the percentage of fat in the heart was practically normal. In cases of nephritis, malignant tumors, and tuberculosis there was some increase of fat (average 10 per cent), but the amount present in myocarditis and chronic valvular disease was within the limits of normal.

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[34] Taylor: Journal of Medical Research, 1903, IX, p. 59.

[35] Fischler: Virchow's Archiv, 1902, CLXX, p. 100.

[36] Kraus: Cent. für allg. Path., 1904, XV, p. 41.

[37] Hester: Virchow's Archiv, 1901, CLXIV, p. 293.

[38] Hagemeister: Virchow's Archiv, 1903, CLXXII, p. 72.

[39] Osler: Principles and Practice of Medicine. Fifth edition, New York, 1902, p. 749.

[40] Osler: Loc. cit., p. 750.

[41] Krehl: Deutsches Arch. f. klin. Med., 1893, LI, p. 416.

The estimation of the facts by the microscope, if carried out in a thorough manner, has certain advantages over the chemical method. The latter is open to the objection that all the fat present in the intermuscular tissue cannot be removed. But what is more important, the location of the fat, and the degree of destruction of contractile substance in the muscle is not ascertained.

Extreme deposition of fat in one part of the heart might indicate greater injury to its working power than a larger amount uniformly distributed. The stimulation for the systolic contraction arises in the muscle fibres of the auricles near the great veins. It is quite possible that a fatty change at this point, or in His' bridges, which transmit the contraction from auricle to ventricle, might impair the action of the heart while an equal fatty alteration elsewhere would not. Unfortunately no exact data are available on these points. So far as I know systematic investigations of the distribution of fat and the associated alterations in the contractile substance of the heart have not been made. I have recently adopted the method of examining teased specimens from 25 different portions of the myocardium selected as follows: Three examinations of each auricle; (1) near the orifices of the great veins; (2) near the auriculo-ventricular valve; (3) in the middle of the auricular wall. Seven examinations of the left ventricle; (1) near aortic ring; (2) near mitral ring; (3 and 4) Centres of anterior and posterior papillary muscles; (5) apex; (6) posterior wall, midway between base and apex, beneath pericardium, (7) posterior wall, midway between base and apex, center of muscle (8) posterior wall, midway between base and apex, beneath endocardium. Seven examinations of the right ventricle; (1) near pulmonary valve; (2) near tricuspid ring; (3 and 4) centres of two papillary muscles; (5) near apex; (6) anterior wall midway between base and apex, beneath pericardium; (7) posterior wall midway between base and apex, central muscle; (8) posterior wall midway between base and apex beneath endocardium. Three examinations of septum (1) beneath endocardium of right ventricle; (2) beneath endocardium of left ventricle; (3) in center of muscle.

The fresh tissue is teased out and treated with glacial acetic acid. Fat cannot be distinguished from the myelin droplets of Kaiserling,[42] by this method, but inasmuch as myelin droplets have never been found in the heart there is no valid objection to the use of acetic acid in this study. The use of Kolossow's method,[43] would prevent error, as myelin is only tinted a light gray by osmic acid.

In certain cases it might be desirable to examine ten or twenty-five additional portions of the muscle. A few bits of tissue showing the most marked fatty metamorphosis are treated by Kolossow's method.

The heart is then hardened in 10 per cent of formalin and a systematic examination of the structural alterations in the coronary arteries, muscle fibres, or interstitial connective tissue can be made by Krehl's method. The examination for fat can be continued by means of frozen sections stained with sudan III or scharlach R. The advantages of this method may be illustrated by a recent case in which there was profound anæmia resulting from purpura hæmorrhagica. The heart was large, weighing 440 gms., and there was marked dilatation of both ventricles and auricles. The typical picture of advanced fatty degeneration was presented. The heart was flabby, soft and yellow. The endocardium of the left ventricle mottled. The valves and coronary arteries appeared healthy. There was no arterio-sclerosis elsewhere and the kidneys were normal. A teased specimen of a papillary muscle attached to the mitral valve showed the muscle fibres were studded with fat. It certainly seemed in this case more than in any other of my series that weakness and dilatation were due to extensive fatty metamorphosis.

But the examination for fat made according to the method outlined above showed that only in the papillary muscles was the fatty change of a high degree. Very little fat was found except beneath the endocardium of the left ventricle. The middle and outer portions of the left ventricular wall the right ventricle and both auricles, were practically free from fat. Surely in this case cardiac dilatation was not due to fatty metamorphosis.

At the Boston City Hospital during the years 1898 and 1899, 477 autopsies were performed. In 120 of these the statement is made in the autopsy protocols that fat was found in the myocardium on examination of a teased specimen or frozen section. According to this, fatty metamorphosis occurred in 25 per cent of all the cases that came to autopsy during these two years. My friend Dr. H. A. Christian found fatty metamorphosis of the heart in 22 out of 27 consecutive cases examined. In nine of these the fatty change was marked. Only one portion of the myocardium, usually the wall of the left ventricle, or one of its papillary muscles, was examined. It is generally agreed that the papillary muscles of the left ventricle are the most common site of the fatty lesion.[44] We can draw no conclusion from these statistics in regard to the existence of the fatty change in other parts of the heart.

The presence of fat in moderate amounts may not be associated with apparent injury to the heart muscle. Virchow stated than even in well marked degeneration the primitive fibres were preserved. The contractile substance is known to be very resistant to autolytic changes.[45] And Ribbert [46] points out that mitotic figures can sometimes be seen in fatty degenerated cells.

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[42] Kaiserling und Orgler: Virchow's Archiv, 1902, CLXVII, p. 296.

[43] Kolossow: Zeit. f. wissen. Mikros., 1892, IX, p. 38.

[44] Cowan: Journal of Path. and Bact., 1902, VIII, p. 183.

[45] Dietrich: Cent. f. Path., 1904, XV, p. 84.

[46] Ribbert: Lehrb. d. allg. Path., Leipsic, 1901, p. 216.

Experimental researches fail to show that the presence of fat in the muscles interferes with the work of the heart. Dr. Welch,[47] found that in rabbits with marked fatty degeneration of the heart, the blood pressure and the reaction to vagus stimulation was normal. He observed rhythmical contraction in a group of muscle fibres filled with fatty globules. The degeneration was so advanced that only an indistinct trace of striation could be detected. Bálint[48] produced aortic insufficiency experimentally in dogs and then poisoned them with phosphorus, but no signs of cardiac weakness developed although the hearts were extremely fatty. Hasenfeld and Fenyvessy,[49] in a recent experimental study have shown that even marked fatty degeneration of the heart does not notably reduce its reserve power.

We have examined the evidence furnished by anatomical, chemical, and experimental investigations without finding any support for the theory that fatty metamorphosis of the heart is the cause of cardiac insufficiency.

The cases which Stokes[50] studied with such care and so graphically described certainly suffered from cardiac weakness. The feeble impulse, faint or absent heart sounds, the dilated heart, and the associated slow and irregular pulse indicated this.

Cheyne, Adams, and Stokes were careful observers, and the error into which they fell was unavoidable. Corvisart had asserted his belief that an anatomical basis for all disturbances in cardiac function could be found if one would but seek it and lamented that the study of morbid anatomy was neglected. The men of the Dublin School studied their cases anatomically as well as clinically. They were looking for alterations in the heart structure in cases of cardiac weakness and they found them. The appearance of a heart, the seat of marked fatty metamorphosis is so striking that it was but natural they should ascribe to this lesion the most serious disturbances of function.

Doubtless many factors are concerned in the production of cardiac insufficiency and probably almost every case is the result of a combination of injurious influences acting upon the heart muscle. There can be little doubt, however, that disease of the coronary arteries is one of the most frequent causes of cardiac insufficiency. And that the clinical picture which Stokes drew was not one of fatty degeneration but of arterio-sclerosis. Balfour,[51] has for many years taught that fatty heart could not be distinguished clinically.

It should be remembered that fibrous myocarditis and coronary sclerosis are not synonyms.[52] Fibrous myocarditis is rare and coronary sclerosis is common. Fibrous myocarditis although frequently associated with coronary sclerosis may occur independently. The symptoms of the two diseases are not identical, although it is often impossible to make a differential diagnosis.

If one will look over the series of cases of fatty heart collected by Stokes,[53] it will be seen that extensive disease of the coronary arteries was frequently noted. Stokes himself commented on this, but he thought coronary disease was simply an adjunct. Among the 83 cases of fatty heart collected by Quain,[54] the coronary arteries were reported ossified or obstructed in 25. In only three cases was it stated that they were healthy. Naked eye examination is not sufficient to exclude coronary sclerosis. In such cases systematic microscopical examination may reveal disease as Krehl and Dehio[55] have shown. Disease of the coronary arteries not only gives rise to the coarse anatomical alterations that have been so fully studied by Köster, Ziegler and Weigert, but to finer changes in the cells the result of interference with their nutrition and blood supply.

Sometimes examples of extreme sclerosis of the coronary arteries are found in individuals who never suffered from cardiac weakness or distress. Osler cites the case of the eminent Scotch divine Chalmers which was reported by Begbie.[56] Sudden death occurred which was attributed to advanced fatty degeneration. But the autopsy record states that "the coronary artery was loaded with calcareous deposit, much contracted, and in one place obliterated, presenting considerable resistance to the knife." I performed an autopsy for Dr. Hildreth on the body of a well-known scientist, a man of great mental and bodily vigor, who died suddenly. He had never complained of cardiac distress. The coronary arteries were found converted into calcified tubes and their lumina greatly narrowed. It is interesting to note that the arterio-sclerosis was limited to the coronary vessels. The protocol is as follows:

ANATOMICAL DIAGNOSIS.—*Thrombosis of right coronary artery; sclerosis of coronary arteries; chronic interstitial myocarditis; periarterial epicardial fibrous nodules; œdema of the lungs; hypertrophy and dilatation of heart; congestion of liver, kidney and spleen; chronic fibrous pleuritis.*

Body of a strongly-built and well-nourished man, aged 53 years, length 170 cm. Autopsy 22 hours post mortem. Rigor mortis present. Pupils dilated slightly, equal.

Subcutaneous fat 2 cm. thick over abdomen. Thoracic muscles deep red.

Peritoneal cavity: Omentum rich in fat. Lower border bound by light adhesions to anterior abdominal wall opposite umbilicus. Serosa pale, smooth and glistening. Appendix bound down to posterior wall near middle of course by firm adhesions. Diaphragm at 5th interspace each side.

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[47] Welch: Medical News, 1888, LII, p. 403.

[48] Bálint: Deut. med. Woch., 1898, XXIV, p. 19.

[49] Hasenfeld und Fenyvessy: Berl. klin. Woch., 1899, Nos. 4, 6, 7.

[50] Stokes: The Diseases of the Heart and the Aorta, Philadelphia, 1854, p. 331.

[51] Balfour: Clinical Lectures on Diseases of the Heart and Aorta, Philadelphia, 1876, p. 283. Balfour: The Senile Heart, New York, 1894, p. 32.

[52] Krehl: Die Erkrankungen des Herzmuskels. Nothnagel's spec. Path. u. Ther. Vienna, 1901, pp. 313, 337. Kelle: Deutsches Arch. f. klin. Med., 1899, XLIX, p. 442. Romberg: Die Krankheiten des Herzens. Ebstein-Schwabebe's Handbuch der Praktischen Medicin. Stuttgart, 1899, p. 755.

[53] Stokes: Loc. cit.

[54] Quain: Med. Chir. Trans., London, 1850, XXXIII, p. 121.

[55] Dehio: Deutsches Arch. f. klin. Med., 1899, XXII, p. 1.

[56] Begbie: Contributions to Practical Medicine. Edinburgh, 1862, p. 196.

Costal cartilages completely calcified.

Pleural cavities: Left pleural cavity free from adhesions. Right cavity completely obliterated by old fibrous adhesions, but the pleura is not noticeably thickened.

Pericardial cavity dry. Serosa smooth and glistening.

Heart weight 470 gms. There is universal hypertrophy and slight general dilatation. There is a rather thick deposit of fat over the epicardium, especially of the right ventricle. Over the coronary arteries are numerous minute pearly nodules in the substance and elevated slightly above the surface of the epicardium. Small plates similar in appearance are in the epicardium over the left coronary sinus. They average 1 mm. in size. The pulmonary artery is opened in situ and found empty. The right ventricle and auricle are distended with dark fluid blood.

The myocardium of the left ventricle contains many grayish-white semi-opaque areas of fibrous tissue, ranging in size from 0.3 cm. to 2 cm. The outlines of these islands are not sharply marked; they cut readily, the consistence not being notably greater than that of the surrounding muscle tissue, which is deep red in color. The fibrous masses are chiefly within the interior of the heart wall; a few reach the endocardium. They occur in greatest number near the middle of the ventricle, only a few are near the apex. The wall of the ventricle is of nearly uniform thickness. Wall of right ventricle normal; papillary muscles not thickened. Aortic segment of mitral valve white and opaque, but not thickened; chordee tendineæ not shortened. Other valves normal. Root of aorta thin, elastic; intima healthy save for a few yellowish flecks.

Both coronary arteries are narrowed, thickened and largely calcified. The left, at a point 1 cm. from its origin, is converted into a calcareous tube, the lumen of which is scarcely 2 mm. in size and filled with soft yellow atheromatous material. The lumen of the descending branch of the left coronary is reduced by obliterating endarteritis to a mere slit.

In the right coronary artery, 2 cm. from origin, is a reddish-gray organizing mural thrombus 1.5 cm. long. It is firmly adherent and the narrowed lumen is plugged by a soft white mass 3 mm. long.

Measurements: Tricuspid valve 14 cm.; pulmonary valve 7.5 cm.; mitral valve 10.5 cm.; aortic valve 9 cm.; left ventricle 1.6 cm. thick; right ventricle 0.4 to 0.5 cm. thick.

The lungs are voluminous, moderately œdematous and congested. They are crepitant throughout.

Spleen weight 170 gms. Rather firm; four notches in anterior border. It cuts readily, and is deep red on section; pulp not increased.

Stomach and intestines appear normal.

Liver does not extend below costal margin. Normal consistence; lobular markings rather obscure. Gall bladder normal.

Kidneys: Equal size. One measured 12 x 5.5 x 4 cm. and weighed 200 gms. Firm, cuts easily. Capsule strips readily from a smooth dark red surface. On section dark red. Cortex 8 mm. wide; glomeruli appear as deep red points. Neither branches of renal arteries nor main artery notably thickened.

Aorta smooth, wall not thickened, elastic; few areas of fatty degeneration in intima.

Brain weight 1400 gms. Both hemispheres symmetrical. Pia normal. Vessels at base not sclerotic.

Microscopic examination of fresh tissues: No fat visible in kidney or heart muscle.

Microscopic examination.—Heart: The white firm areas detected on naked-eye examination are composed of rather loose areolar connective tissue containing thin-walled blood-vessels filled with blood. From these areas the muscle cells have entirely disappeared. Elsewhere the muscle fibres, save for slight vacuolization, appear normal. There is no diffuse general increase of the interstitial connective tissue. The smaller arteries are apparently not thickened or diseased.

Right coronary artery, 2 cm. below origin: The wall is almost completely converted into hyaline fibrous tissue. The media is thinned, except in a small portion of the circumference. Here only the internal limiting membrane is well preserved. The projection into the lumen, noted at the autopsy, is due to a localized thickening of the intima and is composed of homogeneous hyaline connective tissue, containing numerous slits running transversely. The surface of this nodule is smooth.

Left coronary near origin. The hyaline degeneration is even more marked than in the right coronary. The media is greatly thinned and degenerated. A thick broad layer of the thickened intima has been split off and one end projects into the middle of the lumen. The free end is surrounded by blue-staining amorphous material (atheromatous debris), and beyond this is loose areolar fibrous tissue containing thin-walled vessels. In the meshes are numerous large cells filled with yellow pigment (organization of a blood clot?). A band of this tissue extends from wall to wall through the centre of the lumen. In addition to the thick band, bits of the intima have been torn loose at several points.

Spleen: Hyperæmic; the pulp is filled with red blood corpuscles so that its framework is obscured.

Liver: The intralobular capillaries are uniformly dilated. No sclerosis of blood-vessels.

Kidney: Congested.

It is probable as F. H. Pratt[57] has pointed out that in instances of slow obliteration of the arteries the coronary venous channels especially the veins of Thebesius aid the scanty arterial blood supply sufficiently to maintain the nourishment of the muscle fibres.

The notable progress that has been made in the study of cardiac insufficiency during the last dozen years is largely due to the work of the Leipsic school, especially in the researches of Krehl and Romberg. The work of this group of investigators has emphasized the relation which exists between disturbances of cardiac function and demonstrable lesions in the heart muscle. Krehl[58] found areas of acute interstitial myocarditis in every case of chronic valvular disease examined, and also in the so-called idiopathic cardiac hypertrophy. Romberg[59] and Kelle[60] demonstrated the great frequency of foci of interstitial myocarditis in acute infectious diseases. E. Albrecht[61] has examined twenty-one hearts by Krehl's method and confirms the findings of the Leipsic investigators. Dehio of Dorpat has described a diffuse myofibrosis of the heart occurring frequently in old people. Dehio[62] thinks this formation of fibrous tissue is a compensatory process and regards it as an attempt to strengthen the weak heart walls analogous to Thoma's theory of the formation of connective tissue in the walls of weakened vessels in arterio-sclerosis. This myofibrosis is often strongly marked in the auricles and may cause serious disturbance from the fact that the stimulation which leads to the systole originates in the auricles near the great veins.

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[57] F. H. Pratt: Am. Journ. of Phys., 1898, 1, p. 86.

[58] Krehl: Deut. Arch. f. klin. Med., 1890, XLVI, p. 454. Ibid., 1891, XLVIII, p. 414.

[59] Romberg: Ibid., 1891, XLVIII, p. 369. Ibid., 1892, XLIX, p. 413.

[60] Kelle: Ibid., 1892, XLIX, p. 442.

[61] E. Albrecht: Der Herzmuskel. Berlin, 1903, p. 200.

[62] Dehio: Deut. Arch. f. klin. Med., 1899, XXII, p. 1.

The results of these investigators are based upon the most careful and laborious examination. Krehl's method, which was used also at Dorpat in a modified form, consists in cutting up the entire heart into blocks 1 cm. to 1½ cm. thick and then examining a section from each block.

It must be admitted, however, that all cases of muscle incompetence can not be explained on the basis of definite anatomical changes. Rieder in Bollinger's laboratory has shown that as a rule in so-called idiopathic cardiac hypertrophy, sufficient anatomical alterations are not present.

Fatty overgrowth of the heart or obesity of the heart as older writers termed it, is a feature of general corpulency. There is associated with deposits of fat elsewhere, an excessive accumulation beneath the pericardium, and between the muscle fibres. The adipose tissue may be present in enormous amounts, without disturbing the function of the heart as in a case reported by v. Leube.

The size of the heart is proportionate to the size of the skeletal muscles but the work of the heart is proportionate to the bulk of the body. Hence in obesity an increased amount of work is thrown on the heart. Corpulent individuals frequently have very small and weak muscles and hence the disproportion between the size of the heart and the work to be done is increased. Traube noted many years ago the difference in the behavior of the heart in stout people with strong muscles and stout people with weak muscles.

Cardiac insufficiency may be due to acute over-distension of the heart produced by sudden and violent bodily exertion. In these cases of heart strain the nature of the anatomical or chemical changes is unknown.

No justification exists for attributing cardiac insufficiency to nervous disturbances or exhaustion, the nature of which we know nothing, unless demonstrable lesions in the myocardium have been excluded by a thorough microscopic examination. It should be stated that the results of recent work indicate that the circulatory disturbances which occur during the height of the febrile period in the infectious diseases are probably due less to cardiac insufficiency than to paralysis of the vaso-motor centre in the medulla.[63] The blood pressure falls, the flow of blood is slowed, the heart is only partially filled, and finally the circulation sinks to such a low level that life cannot be maintained.

It is probable that many of the problems connected with cardiac insufficiency can be solved by careful clinical and pathological study. The advances made by the Leipsic school were due to a thorough study of a few cases. There is great need of additional data.

In conclusion it may be stated that there is no evidence to show that fatty metamorphosis of the heart produces cardiac insufficiency. In the light of present knowledge other anatomical alterations, especially coronary sclerosis, and acute interstitial myocarditis must be regarded as the most common causes of heart failure.

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[63] Romberg und Pässler: Deutsches Arch. f. klin. Med., 1899, LXIV, p. 652. Pässler und Rolly: Münch. med. Woch., 1902, XLIX, p. 175. Pässler und Rolly: Deutsches Arch. f. klin. Med., 1903, LXXVII, p. 96.

NOTES ON FORM OF THE CAVITY OF THE KNEE-JOINT.

By Joseph Marshall Flint, M. D.

(From the Hearst Anatomical Laboratory of the University of California.)

It has been a well-known psychological fact that the sensorium finds it difficult to apprehend ideas of positive form when expressed in negative outlines. This has been repeatedly shown by experiment, and is a fact which must have impressed every student of anatomy in the endeavor to obtain clear conceptions of the form of the various cavities in the body. This is particularly true of the pneumatic sinuses of the cranium and of the form of the pleural and peritoneal spaces, as well as the various cavities of the joints. Recently Lee[1] has emphasized this point in a study from this laboratory on the form of the sinus frontalis as displayed by lead casts obtained in the dissecting-room during the periods of routine work. By this method he has succeeded in giving us very clear and definite objective pictures of these negative cavities. When a similar method is adopted for the study of such intricate spaces as the synovial cavity of the knee-joint, many interesting relationships of the different portions of the cavity to each other as well as to the bones that form its boundary are revealed. These cavities, in their normal form, have been the subject of considerable minute study by numerous anatomists. The casts yield nothing new so far as the joint cavity itself is concerned, but give us in three dimensions an excellent objective concept of the form of this space. A partial idea of the outlines of the synovial sac has been obtained by injecting the cavity with gelatine or wax under considerable pressure[2]; but the picture obtained in this was is only partial, inasmuch as all the relationships of the space to the condyles of the tibia and femur respectively are hidden, as well as the extensions of the cavity above and below the semilunar cartilages. In demonstrating the form of this space to students, it has been my practice to inject the cavity with molten Wood's metal, which has a melting-point at about 63° C. The technique is extremely simple. After the joint has been freed from muscles and ligaments, it is immersed in a pan of water having a temperature of about 65°, and is left until the whole specimen is warmed through. After this has taken place, a small hole is made in the capsule and molten Wood's metal poured into the cavity of the joint. The joint is then placed in any desired position, and plunged into cold water, whereupon the metal immediately hardens, and can be easily dissected out, yielding a complete picture in positive form of the shape of the joint cavity. Under ordinary circumstances, it is extremely difficult to inject the entire space at once, and in consequence it is best to make casts from above and below by opening the cavity at the upper extremity of the subpatellar bursa and through the popliteal space. The latter shows the relationship of the extension of the cavity beneath the patella and tendon of the quadriceps femoris while the former demonstrates particularly well the synovial space between the femur and tibia. By superimposing two such casts, one obtains by the combined picture a perfect representation of the cavity at its maximum distention. They serve admirably for the purposes of demonstration, or for museum specimens, and, at the same time, afford excellent material for illustration. Owing, of course, to the fact that the muscular tonus has been removed, as well as any elasticity that the capsule of the joint itself might retain, the form of the space as shown by these specimens must be considered maximal, and paralleling the conditions occurring in life only when we obtain a large effusion into the cavum articulare.

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[1] Lee: Johns Hopkins Hospital Bulletin, April, 1904.

[2] Vide: Poirier et Charpy. Traité d'Anatomie Humaine. T. 1. Paris, 1899. Spalteholz: Handatlas der Anatomie des Menschen. Leipzig, 1896. Fick: Handbuch der Anatomie des Menschen. Jena, 1904.

Literature:

The descriptions of the synovial cavity of the knee-joint as given by the more thorough and standard works on anatomy agree in the main upon the chief characteristics and relationships of the synovial membrane to the ligaments, capsule, cartilages and bones entering into the formation of the joint. As for the general descriptions of the negative spaces, these leave little to be desired. A brief reference to one or two of them accordingly will be sufficient to review our knowledge of these spaces as obtained by the older methods. It would be extremely desirable, however, to have better studies of the average form of this and indeed of all synovial cavities, such as might be obtained from a large number of casts. They could be made not only in full extension like the ones used in this paper but also to show the effect of the various movements upon the form of the cavity. Naturally the difficulty lies chiefly in the expense involved, for Wood's metal of which the casts are made is costly.

According to Morris,[6] the synovial membrane of the knee-joint limits the largest synovial sac in the body. Following the capsule of the joint, it opens into a large cul de sac beneath the extensor tendon on the front of the femur, and communicates with the large bursa interposed between the tendon and the femur. After investing the circumference of the lower end of the femur, it is reflected upon the capsule of the joint which forms the anterior, posterior and lateral ligaments. The crucial ligaments are also covered. The membrane extends over both surfaces of the semilunar cartilages and thence along the inner surface of the coronary ligaments to the head of the tibia, around the circumference of which it extends a short way, and sends an extension to form a bursa for the popliteus tendon. At the back of the articulation two pouches are prolonged beneath the muscles, one on either side, between the femur and head of the gastrocnemius. Another invagination, less sharply differentiated, occurs around the patella. From it arise the alar ligaments.

Spalteholz[4] in a brief description states that the cavum articulare of the knee-joint is regularly in open connection with the bursæ of the popliteus muscle This tubular projection appears on the lateral side, and runs from the under surface of the tendon of origin of the popliteus downwards and backwards. The communication takes place through a small slit above the meniscus lateralis. Beneath the meniscus there is sometimes a second communication, joining the cavum articulare with the tibio-fibular articulation. Above, the cavum is in communication with the bursa suprapatellaris, which lies between the femur and the common tendon of the M. quadriceps femoris. This is customarily cut or traversed by folds, and may at times remain completely separated from the remainder of the knee-joint.

Cunningham[5] described the joint cavity, or rather the synovial membrane which forms its boundary, as a more or less extensive lining of the capsule and the intracapsular ligaments and the free surface of the infrapatellar pad of fat. Upon its surface the membrane forms a fold extending from the lower level of the articular surface of the patella to the anterior portion of the intercondyloid notch. It then extends upward upon the top surface of the extensor tendon, communicating with a large bursa on the front of the femur. Below it covers both surfaces of the semilunar fibro-cartilages, while a prolongation invests the intracapsular portion of the tendon of the M. popliteus. From the back portion of the joint cavity the synovial membrane extends upward, and provides a partial covering for the crucial ligaments. The cavity may, furthermore, communicate with bursæ situated on the inner head of the gastrocnemius and the semimembranosus muscles. Occasionally the communication occurs between the cavities of the knee-joint and that of the superior tibio-fibular articulation.

Cavum articulare:

Casts to display the region between the femur and the patella are best made from an opening in the popliteal space.

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[6] Morris: Anatomy of the Joints. London, 1879.

[4] Spalteholz: Loc. cit.

[5] Cunningham: Text Book of Anatomy. New York, 1902.

In almost all instances the suprapatellar bursa (Figs. 1, H, 2, a, 3, c, 4 a, 6, 1.), communicates with the joint cavities. So regular is this connection that it may readily be considered and described with the cavum articulare. The shape and relations of this projection or diverticulum of the synovial cavity vary within comparatively wide limits in both form and relationship. Commonly it is cut off by a septum (Figs. 1, a, 4, h, 6, a.), from the lateral side which projects a considerable distance across the space, and, in rare instances, entirely separates the bursa from the joint. The communication between the two sacs is almost always on the medial and posterior side. This bursa may extend a distance of 6 or 7 cm. above the upper level of the patella. Ordinarily it is rounded, and, when distended to a maximum, appears to be between 3 and 4 cm. in thickness. Upon its surface, as shown by the casts, is a distinct depression for the tendon of the M. quadriceps femoris. In certain cases, the bursa may appear as a direct continuation of the synovial sac, but from its upper extremity distinct diverticulae (Figs. 2, c, 3, a.), may extend out to increase the area and size of the bursa.

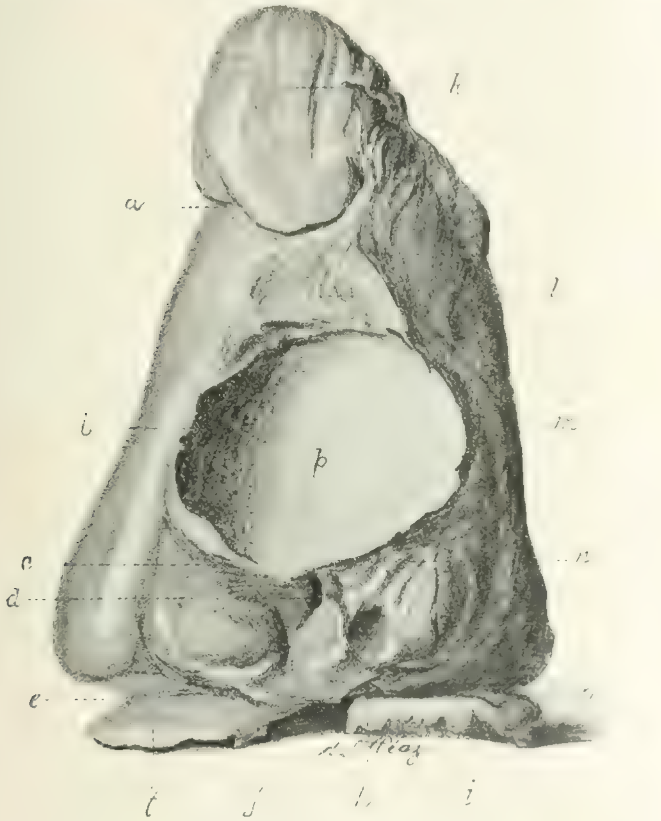
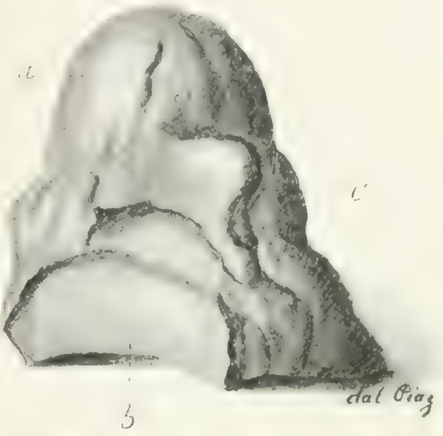


Fig. 1.—Wood's metal cast of the cavum articulare of the right knee-joint. Anterior aspect. ¾ natural size.

a=Septum between bursa suprapatellaris and the cavum articulare.
b=Peripatellar ridge formed by a synovial groove around the patella.
c=Plica aliformis lateralis.
d=Foramen for ligamentum mucosum passing from lower border of patella to intercondyloid notch.
e=Space for meniscus lateralis.
f=Extension of cavum articulare between the meniscus lateralis and the facies articularis of the condylus lateralis of the tibia.
g=Groove for the so-called ligamentum anterius of the meniscus lateralis.
h=Notch for ligamentum cruciatum anterius.
i=Extension of cavum articulare between the meniscus medialis and the facies superior of the condylus medialis.
o=Space for the meniscus medialis.
n=Plica aliformis medialis which, with its mate c., forms the plicae alares.
m=Medial ridge formed by the peripatellar groove.

At the same time lateral and longitudinal folds of the synovial membrane frequently form depressions and sulci upon the surface of the casts. These appear most numerous on the surface of the bursa suprapatellaris and the point of reflection of the membrane from the sides of the condyles of the femur.

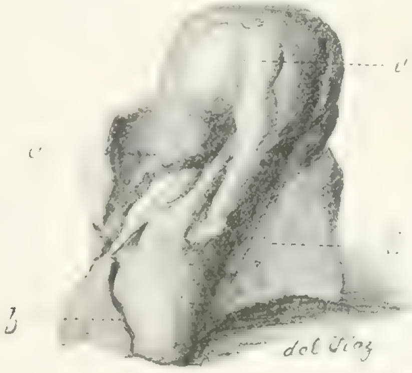


Anterior View Upper Part of Cavum Articulare Showing Diverticulum from the Bursa.

Fig. 2.—Wood's metal cast of the upper part of the cavum articulare of left knee-joint and the bursa suprapatellaris showing a diverticulum from the bursa. Anterior view. ¾ natural size.

a=Bursa suprapatellaris.
b=Impression of patella with lateral and medial facies. Above the patella the impression of the tendon of the M. quadriceps femoris is visible.
c=Diverticulum.

The bursa suprapatellaris commonly extends a distance of from 2 to 3 cm. above the upper edge of the articular surface of the femur. The cavum articulare, as shown by the cast viewed from above and behind (Fig. 3), is divided at the level of the intercondyloid notch, where there is always a foramen made by the ligamentum mucosum, as it passes from the alar ligaments of the patella to its insertion upon the upper part of the intercondyloid notch. Above this point, the impressions of the femoral condyles are clearly seen as well as the mark of the facies patellaris femoris. From this

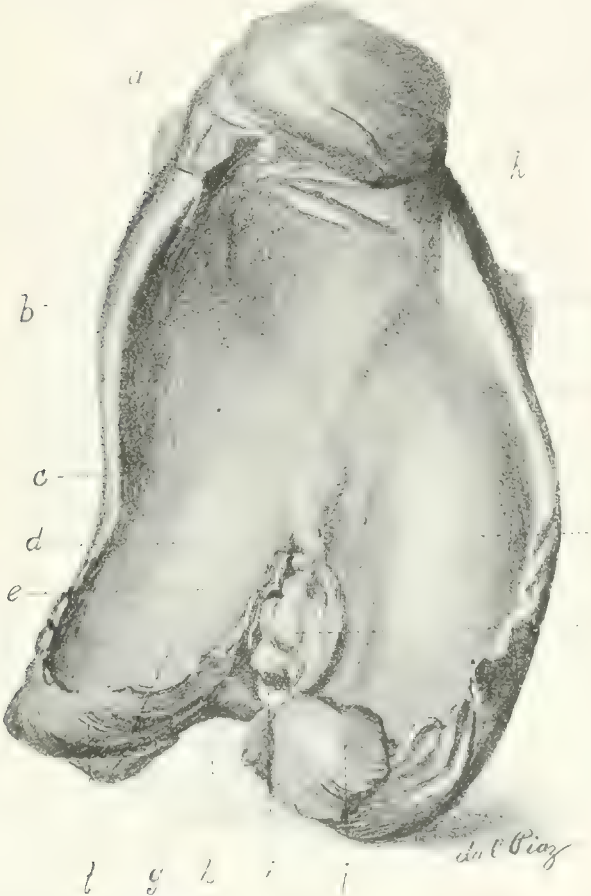


Posterior View of Same Cast Shown in Fig. 2. ¾ Natural Size.

Fig. 3.—Lateral and posterior view of same cast as shown in Fig. 2.

a=Diverticulum from suprapatellar bursa.
b=Septum or fold of synovial membrane in lateral wall of cavum articulare.
c=Bursa suprapatellaris.
d=Impression of the condyles of the femur.

medial point, the cast not only shows very clearly the extension posteriorly of both condyles but also the projection of the sac into the intercondyloid fossa as well as the line of its reflection all the way around the condyles of the femur. At the edge of the femoral condyles about the line of attachment of the capsule, there may be a considerable thickening of the cast, indicating that the synovial sac is large at these points. Ordinarily this fold is thicker on the external than on the internal condyloid edge of the femur. Viewed from behind and above, the cast also shows a very marked notch (Fig. 4), between the two condyles where the synovial membrane is reflected or passes over the crucial ligaments. The relationship of the membrane to the ligamentum cruciatum anterius is clearly shown, as this forms by its partial synovial investiture the major portion of the notch. Anteriorly the continuation of the ligamentum cruciatum anterius with the meniscus medialis is distinctly seen as a definite groove. Above, the limits of the condyle are very evident; but there is, however, no indication of the presence of the patella, as that, on account of the distention of the cavum articulare, is pressed some 2 cm. away from the patellar surface of the femur.



POSTERIOR VIEW OF CAVUM ARTICULARE OF KNEE-JOINT. SAME CAST AS FIG. 1. ¾ NATURAL SIZE.

FIG. 4.—Posterior view of same cast of the cavum articulare as shown in Fig. 1.

a = Bursa suprapatellaris.
c = Margo medialis of the cavum articulare marking the line of reflection of the synovial membrane from the femoral condyles to the capsule of the joint.
b = Superior margin of the condylus medialis.
d = Impression of the condylus medialis.
e = Foramen for the transmission of the ligamentum mucosum.
f = Portion of cavum articulare between the meniscus medialis and the posterior part of the condylus medialis of the femur.
g = Extension of the synovial cavity between the meniscus medialis and the superior face of the condylus medialis of the tibia.
h = Groove for the ligamentum cruciatum posterius.
i = Groove for the ligamentum cruciatum anterius.
j = Portion of cavum articulare at the posterior surface of the condylus lateralis of the femur.
k = Septum between the bursa suprapatellaris and the cavum articulare.
l = Ridge about the patella.
m = Upper margin of condylus lateralis of femur.
n = Lateral margin of the cavum articulare where the synovial membrane is reflected from the lateral condyle to the capsule of the joint.
o = Impression of the condylus lateralis.
p = Extension of the cavum articulare behind the origin of the lig. cruciatum anterius in the intercondyloid notch.

The anterior aspect of the synovial cavity (Fig. 1) is limited above by the bursa suprapatellaris and the extensor tendon (Fig. 1, k and 1), in the middle, by the articular surface of the patella (Fig. 1, p), and the capsule of the joint, and below by the two semilunar cartilages and coronary ligaments (Fig. 1, e, o, f and i). In general, the entire form of the cast is pyramidal, although quite irregularly so. Above, the rounded apex is formed by the bursa suprapatellaris, which we have previously described. Following the attachment of the capsule and the fibrous expansions of the extensor tendons immediately above the patella is the sulcus in the tendon itself. The patella is shown as a deep depression in the cast, its medial and lateral facets clearly visible.

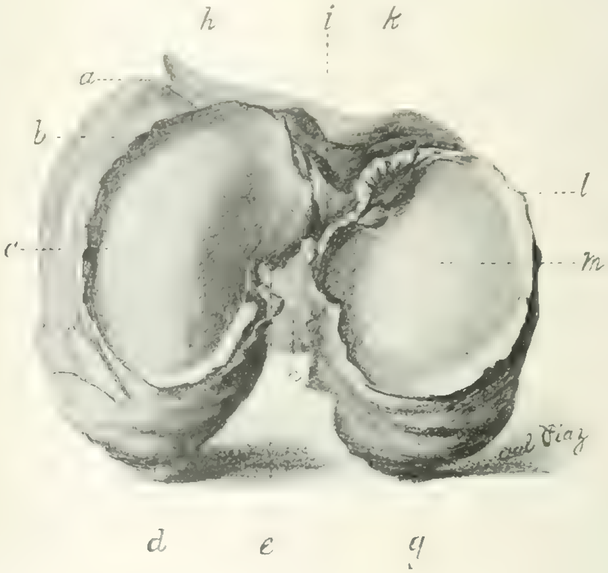


FIG. 5.—Under surface of the cavum articulare from same cast as Fig. 1. ¾ natural size.

a = Depression about patella formed by extension upwards of the plica aliformis lateralis.
b = Lateral limit of portion of cavum articulare between the meniscus lateralis and the condylus lateralis of the tibia.
c = Impression of the condylus lateralis of the tibia.
d = Portion of cavum articulare between the condylus lateralis of the femur and the capsula articularis.
e = Groove for the ligamentum cruciatum posterius.
g = Portion of cavum articulare between the condylus medialis of the femur and the capsula articularis.
h = Lateral articular facet of the patella.
i = Groove for the ligamentum cruciatum anterius.
k = Medial articular facet of the patella.
l = Medial limit of the portion of the cavum articulare extending between the meniscus medialis and the condylus medialis of the tibia.
m = Impression of the condylus medialis of the tibia.
n = Bursa suprapatellaris seen through the notch formed by the crucial ligaments.

It is surrounded by a sharp, elevated ridge formed by the infolding or invagination of the synovial membrane around the edge of the patella which may be termed the peripatellar groove (Fig. 1, m and h). Immediately below is a depression which terminates in a foramen caused by the ligamentum mucosum as it passes from the patella to the edge of the intercondyloid notch. The depression which converges from the borders of the patella is formed by the plicæ alares (Fig. 1, c, n). Below the foramen, we find a notch in the cast (Fig. 1, h), formed by the ligamentum cruciatum anterius as it passes forward, and it is attached into the fossa in front of the spine of the tibia just behind the transverse ligament. This notch is continuous with the depression formed by the meniscus medialis. On the opposite side is a well marked groove (Fig. 1, g), formed by the ligamentum transversum genu, which is continuous with the depression (Fig. 1, or the anterior and medial aspect of the depression formed by the meniscus lateralis. The extensions of the cavum articulare beneath the two semilunar cartilages are very beautifully shown, extending out to the margin of the condyles of the tibia where they are limited by the so-called coronary ligaments.

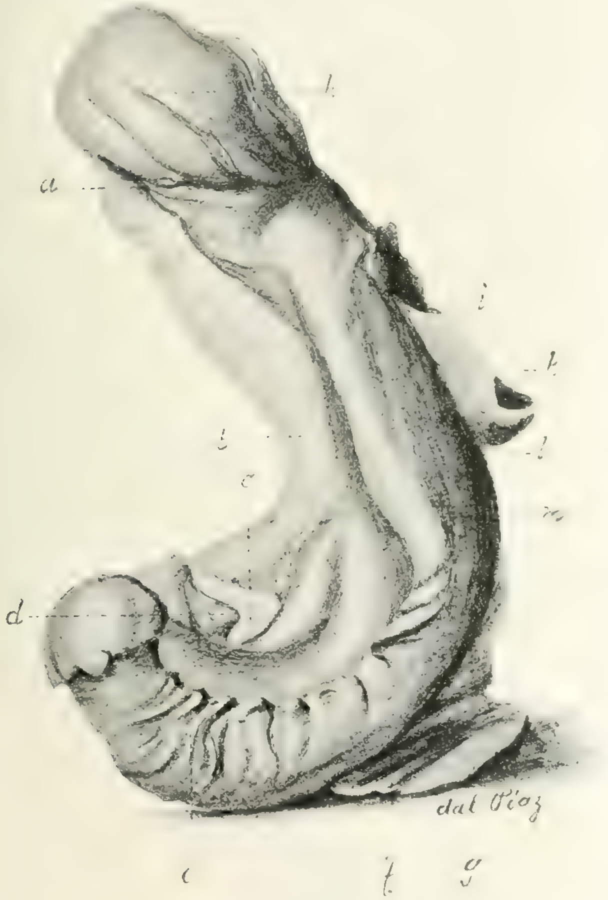


Fig. 6.—Lateral view of the Cavum Articulare of the knee-joint. Same cast as Fig. 1.

a Septum between the bursa suprapatellaris and the cavum articulare.
b Impression of the condylus medialis of the femur.
c=Groove for ligamentum cruciatum anterius.
d Projection of the cavum articulare into the intercondyloid notch behind the origin of the ligamentum cruciatum anterius.
e Portion of the cavum articulare between the condylus lateralis of the femur and the capsula articularis. The folding is due to reduplication in the capsule of the joint.
f Space occupied by the meniscus lateralis.
g Extension of the cavum articulare between the meniscus lateralis and the condylus lateralis of the tibia.
h Bursa suprapatellaris.
i Impression of the patella.
k Groove about the patella.
l=Depression formed by the plicae alares and the ligamentum mucosum.
m Lateral margin of the cavum articulare.

The cast of cavity of the knee-joint, viewed from below or better from the tibial aspect (Fig. 5), shows the articular surfaces of the two condyles of the tibia represented as concave surfaces with the thin, sharp edges marking the line of attachment between the capsule of the joint and the condyles of the tibia. The synovial space between the condyles and the semilunar cartilages is extremely thin and delicate, and extends ordinarily only over the anterior three-fourths of the condylar surface. Here in the tibial as well as in the femoral view, the distinctly marked notch formed by the reflection of the synovial membrane over the crucial ligaments is shown (Fig. 5, n). In addition, there is a secondary notch where the anterior crucial ligament passes to the point of its attachment near the anterior border of the meniscus medialis (Fig. 5, i). A synovial diverticulum passes in front of the crucial ligament at this point, and is derived from the part of the cavity between the condylus medialis and the meniscus medialis. A depression at the lateral edge of the intercondyloid notch of the femur shows the impression of the posterior crucial ligament (Fig. 5, e). The lateral aspect of the cast (Fig. 6) shows, particularly at the point of attachment of the capsule to the lateral condyle of the femur, numerous rugæ (Fig. 6, e), caused by the folding of the synovial membrane at this point. Above, the cast becomes more rounded, and finally opens into the suprapatellar bursa (Fig. 6, h). The projection about the edge of the patella (Fig. 5, h), forming the peripatellar groove is distinctly and clearly marked. The medial aspect is somewhat flatter and sharper than the lateral, and does not show the same marked folding as is observed on the lateral aspect of the cast. Within, the impressions of the femoral condyles are seen while at the intercondyloid fossa just in front of the notch formed by the crucial ligaments (Fig. 6, c), is a slight projection of the cavum articulare into the intercondyloid fossa. Behind the notch is another projection (Fig. 6, d), extending into the fossa posterior to the ligamentum cruciatum anterior.

In general, the form varies considerably in different joints, and the complicated infoldings and relationships shown by these specimens indicates only too well the difficulty in trying to get an adequate concept of the form of the cavum articulare from ordinary dissections or even from the distended synovia which can be obtained by injecting the cavity with gelatine or other substances. It emphasizes, moreover, the necessity of positive expressions of these negative spaces in order to give direct and visual images which we can project into the cavity of the joint itself. The surgical interest of these casts, moreover, is of not a little importance, as in extensive effusion, either purulent or serous, into the cavum articulare must necessarily take the form which is shown by these casts. The reason why, for example, effusions into the joint are never visible or palpable from the popliteal space becomes immediately apparent, for in this region the extensions of the synovial cavity are not marked. They also indicate the areas where an opening into the joint would give access to the greater part of the cavity, and suggest also the regions which should be carefully observed in washing out or aspirating the joint in various surgical procedures.

THE REPORT OF A CASE OF ACUTE MYELOGENOUS LEUKÆMIA.

By Hermon C. Gordinier, M. D., Troy, N. Y.

The only form of acute leukæmia mentioned by the authors of our modern text-books of practice is the lymphatic. No mention so far as I have been able to ascertain is made of the acute myelogenous form. Of the various works on hæmatology at my disposal only three, Ewing, Grawitz, and Bramwell mention this type of leukæmia.

Ewing states "That, of the recent cases of acute leukæmia in which the type of the disease was satisfactorily determined, Fraenkel (1895), could find only three of the myelogenous type, the great majority being of the lymphatic variety.

In 1897, the writer saw three cases of rapidly fatal leukæmia verified by autopsies, and all of the myelogenous type. They occurred in the services of Drs. Thompson and Delafield at Roosevelt Hospital. In two of the cases the changes in the blood were from the first observation typical of the condition and the marrow was puriform, while the spleen and lymph nodes were but slightly affected. In the third case on the first examination there was found a leucocytosis of ordinary inflammatory grade, five per cent of the cells were, with difficulty, recognized as myelocytes. Later the leucocytosis and the proportion of myelocytes increased and the diagnosis of acute myelogenous leukæmia, made with reserve, just before death, was verified at the autopsy."

Grawitz, reports the case of a spinster, age forty-two years, with previous good health. This condition followed a long continued hemorrhage, the result of extracting fourteen teeth at one sitting. The patient had a severe stomatitis and necrosis of the jaw; this was followed by great prostration, retinal hemorrhage and enlargement of the spleen. The diagnosis of acute leukæmia was made. Leucocytes 190,000; small mononuclears five per cent, large mononuclears fifteen per cent, polynuclears ten per cent, sixty per cent neutrophile myelocytes and ten per cent eosinophile myelocytes. Death occurred in two weeks.

Bramwell in his work on anæmia mentions acute myelogenous leukæmia and refers to the following case with recovery. "A labourer came under my care in 1870. He had been ill three weeks, there was some, though not marked, febrile disturbance. The patient was pale and cachectic looking, his color resembled that of pernicious anæmia, the spleen extended down almost to the pelvis, the lymphatic glands were not enlarged, there was no hemorrhage, the blood contained an enormous excess of white cells, they appeared quite as numerous as the reds. At that time physicians were not in the habit of counting the corpuscles, and I cannot say what the exact proportion of the white and red cells was, the appearance of the blood was in every way characteristic. I was well acquainted with the disease, splenic leucocythæmia as it was then termed from Bennett's teaching and from the cases which I had seen in the Edinburgh Royal Infirmary. The case just recorded is so far as I know unique, inasmuch as it ended in recovery, and that, so far as I could judge from the microscopic characters of the unstained blood, the white cells were of large size and coarsely granulated, in other words the case was one of acute spleno-medullary (and not lymphatic) leucocythæmia."

In the American Journal of the Medical Sciences for September, 1903, Billings and Capp in an exhaustive article directs the profession's attention to acute myelogenous leukæmia. They reported one case and collected from the literature seven other positive cases, thus establishing this type of leukæmia as a distinct clinical entity. Heretofore the only form of acute leukæmia generally recognized was the lymphatic. Since the appearance of their article I have been able to collect from the literature, ten cases of acute leukæmia all of which were of the lymphatic type. I also found an undoubted case of acute myelogenous leukæmia reported in 1902, by Stewart and Campbell. (This case seems to have been overlooked by Billings and Capp). It was in a child six years of age, the blood showed, toward the end of the disease which ran its course in two months, the following condition. Hæmoglobin twenty-one per cent, Red cells 750,000, leucocytes 40,000; lymphocytes small twenty-five per cent, myelocytes thirty per cent.

Author's Case.

A. C. T. Age fifty-six years, married, merchant by occupation. Admitted to my service at the Samaritan Hospital, April 4, 1903, complaining of great weakness, cough, sleeplessness, and complete anorexia.

Family History.—Mother died of bronchitis. Father of small-pox. Lost one brother of tuberculosis. Has a brother and sister living and in good health.

Personal History.—Fourteen years ago had a severe attack of *lagrippe*, otherwise has been healthy until onset of present illness. Has used tobacco to excess, but never used alcoholics in any form. Denies venereal disease of any sort. Present illness began toward the end of December, 1902, with a severe attack of bronchitis which was followed in the course of a few weeks by great fatigue, loss of appetite, chilly feelings, fever and sweats, constant headache, dyspnœa on exertion, throbbing in the head and insomnia. He thinks he has lost about thirty pounds in weight. His cough continues, and he expectorates a muco-purulent sputum.

Physical Examination.—The patient assumes the recumbent posture being too ill to walk. Is of large frame, well built, but with flabby musculature. There is slight general emaciation. Has a cachectic look, color of face of a dusky yellow hue; lips, conjunctivæ and all visible mucous surfaces very pale, gums spongy and bleed easily when rubbed, tongue large, flabby and coated with a white fur. A superficial ulceration exists on left side of tongue near its tip, the size of a silver three cent piece. No cyanosis, no oedema of extremities, superficial veins distended.

Lungs.—Chest symmetrical, intercostal spaces widened, respirations hurried. Percussion note universally vesiculo-tympanitic. The upper liver dulness and the cardiac areas are effaced by this vesiculo-tympanitic note. Expiration prolonged and low in pitch, a few dry and moist râles are heard.

Heart.—The pulse is regular but rapid (120-140 per minute), easily compressed and of fair volume. The apex is not visible or palpable, the muscular element of the first sound is weak, a slight apical systolic murmur is present, not conducted to the left. The pulmonic and aortic sounds retain their normal disparity. A distinct venous hum is present on each side.

Liver.—The hepatic dulness reaches, in the mammillary line from the sixth rib to three centimeters below the free border. The dulness of the left lobe extends six centimeters below the zyphoid cartilage. The lower liver border is palpable, firm in consistency, not irregular, and slightly tender on pressure.

Spleen.—This organ is palpable by dipping one's hand deep below the costal border. Its dullness begins in the eighth interspace and extends downward, in the mid-axillary line, eleven centimeters. Forcible percussion of the spleen elicits no tenderness.

The abdomen is distended, not tender, and generally tympanitic. No evidence of free fluid exists.

Glandular System.—A solitary lymph node is present in the left anterior triangle of the neck, a few pin-head sized lymph nodes exist in each groin, none others are detectable.

Urine.—Light amber, specific gravity 1022, no sugar, trace of albumen, no blood, pus or casts, amorphous urates and abundance of uric acid crystals. Diazo-reaction absent. Amount three pints.

The sputum which was examined several times, disclosed diplococci.

Nervous System.—Mind clear to last. Muscular movements normal but weak. No ataxia, sensations intact. Sternum, ribs and long bones of extremities tender when struck. Pupillary reactions normal. Ocular movements normal. Flamed shaped hemorrhages in each retina. Hearing reduced to three inches from each ear, drum membranes thickened and retracted. The knee-jerks are diminished, otherwise the reflexes are normal. No nerve or muscular tenderness.

Blood.—The freshly drawn blood is thin, runs easily and coagulates slowly, and has a slight whitish tinge. Hæmoglobin twenty-eight per cent (Dare, Tallquist). Erythrocytes 1,500,000 per cmm. Leucocytes 260,000 per cmm. The blood presents a typical picture of myelogenous leukæmia, the specimens, stained with Wright's modification of the Leishman stain, showed a well marked mixed leucocytosis, the myelocytes predominating. A slight degree of poikilocytosis exists. The protoplasm also showed a mild degree of polychromatophilia, but no granular degeneration. Nucleated red cells were common, chiefly of the normoblastic type. An occasional megaloblast was present, perhaps one to every second or third field. No count of the nucleated red cells was made. Numerous eosinophile myelocytes were present containing characteristic coarse and fine granules and pale stained eccentrically placed nuclei. It was often difficult to distinguish between some of the large mononuclear leucocytes and myelocytes with faintly stained granules. Only a few polymorphonuclear eosinophiles were present, an occasional dwarf form was observed. A few mast cells with characteristic basophilic granules were seen. The blood contained many spheric bodies smaller than the average red cell, without a distinguishable surrounding seam of protoplasm. At first, these were thought to be a small type of lymphocyte, but after a more careful study they were considered to be free nuclei which had taken the blue stain. A few myelocytes exhibited mitotic figures. Many degenerated types of leucocytes existed.

Blood Count.	Per cent.
Myelocytes, Neutrophilic	61.4
Myelocytes, Eosinophilic	4.1
Transitionals	1.8
Polynuclear Eosinophiles	.2
Polynuclears	5.8
Mononuclears, Large	24.4
Mononuclears, Small	2.
Mast Cells	.3
	100.

The patient died April 9, 1903, five days after entrance to hospital. No post-mortem examination was permitted. There can, however, be no question about classifying this case as one of acute myelogenous leukæmia. The duration of the symptoms referable to the blood-state was a little over three months (from about January 1, 1903, to April 9, 1903), and the blood picture was absolutely typical of myelogenous leukæmia.

This case together with those recorded in literature brings the number of acute cases of myelogenous leukæmia up to twelve positive and two doubtful ones. The positive cases are recorded by Billings and Capp; (1) Vander Wey; (2) Thompson and Ewing; (3) Grawitz; (4) Ewing; (5)

Hirschfeld and Alexander; (6) Michaelis; (7) Bramwell; (8) Stewart and Campbell; (9) Turck; (10). The two doubtful cases are recorded by Obrastow; (11).

References.

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(4) Grawitz: Pathologie des Blutes, p. 318, 1902.
(5) Ewing: Clinical Pathology of the Blood, p. 212, 1901.
(6) Hirschfeld & Alexander: Ber. Clin. Wochen. No. 11, 1902.
(7) Michaelis: Zeitschr. f. klin. Med., vol. XLV, p. 87, 1902.
(8) Bramwell: Anæmia, p. 146, 1899.
(9) Stewart & Campbell: Montreal Med. Jour., p. 272, 1902.
(10) Turck: Zeitschrift f. innere Medicin, No. 13, p. 336.
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THE HISTORY OF SOME FAMOUS QUACKS.[1]

By Francis R. Packard, M. D., of Philadelphia.

Although a dissertation on successful quackery may seem out of place before an audience of honest physicians, nevertheless, there have been, and unfortunately still are some phases of the subject which may claim attention because of their human interest, although they are destitute of scientific value. There is in most successful quacks some distinctive quality or characteristic to account for their achievements. Paracelsus, who may serve as the prototype of the modern quack, was undoubtedly a man of intellectual attainments, and possessed of supreme cleverness. He also possessed a characteristic, which seems to be an essential requisite to all successful quackery, namely the most superb self-confidence. His very name is indicative of his career,—Aurelius Phillippus Theophrastus Paracelsus Bombastus ab Hohenheim, and savors of his magnificent pretensions. It is probably impossible for us to appreciate the astounding audacity of his action when, while professor of Physic and Surgery, in the University of Basel, he burnt the works of Galen and Avicenna publicly in his lecture room, accompanying the performance by a speech in which he modestly claimed that all the academies had less experience than his beard, and that his hat knew more than all the doctors. In spite of Browning's wonderful poem, which may be regarded as an attempt at an apotheosis of Paracelsus, there is no doubt that he was a quack pure and simple. His sole credit was that he broke from the traditions of the past and shattered some of the idols of medieval medicine.

Webster defines a quack as "a boastful pretender to medical skill; an empiric, an ignorant practitioner." Those to whose careers I wish to call your attention briefly to-night belong to the first class. They were all boastful pretenders to medical skill, though some of them were not so ignorant. Under this head for many generations we might have classed the sovereigns of England, the mere touch of whose hand was held to be an absolute cure for scrofula, a therapeutic measure from which the condition derived its other name, "King's Evil." That this opinion was not confined alone to the uneducated classes was demonstrated by the fact that the august possessors of the virtue not only practised it but repeatedly asserted their claim to it.

During the period of the restoration especially submission to the royal touch as a cure became very popular as a manifestation of loyalty. Another circumstance which contributed to maintain the royal touch in popular estimation was the fact that it was always accompanied by the gift of a gold piece to the patient from his sovereign. These were known as "touchpieces." It is interesting in this connection to recall that Dr. Samuel Johnson, the great lexicographer, was among those touched for this complaint by Queen Anne, the last of England's royalties to attempt the exercise of this healing faculty.

Valentine Greatrakes.

In twenty-two years a careful list was kept of those of his subjects whom Charles II touched for King's Evil, and their number amounted to over 92,000. There were, however, other claimants to the healing touch besides those of royal birth, among whom Valentine Greatrakes, achieved a remarkable fame. He was born in County Waterford in the reign of Charles I, and after an ordinary school education entered Trinity College, Dublin, from which place he did not graduate as, owing to the rebellion his mother fled from Ireland into England, where he lived in Devonshire and studied theology and philosophy under a German minister, the Reverend John Daniel Getsius. About the year 1624, he returned to Ireland, but he is said to have been so extremely affected by the miserable state of that unfortunate country that he retired to the Castle of Caperquin where he spent a whole year in melancholy reflections on the vicissitudes of fortune. In the year 1649, he entered the army as a lieutenant, serving against the Catholics who were stirring up trouble in Munster. In 1656 he left the army and ever after lived upon his estate at Affane. He was possessed of property, and was evidently held in some esteem for he became a justice of the peace and registrar for plantations.

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[1] Read before the Johns Hopkins Hospital Historical Club, April 11, 1904.

How this quiet, contemplative, well-to-do country gentleman ever became possessed with the idea that he was gifted with the ability to heal disease by the touch of his hand will never be known. In 1662, however, he claimed to have discovered his supernatural gift, although for some time it appears he kept the virtue to himself, but at last, like the good man that he was, told his wife, who unkindly laughed at him. Nothing daunted, however, he began laying his hands upon various people in the neighborhood who suffered from scrofula or other diseases, and is said to have cured very many of them. These doings made such a noise, however, that they came to the ears of the authorities, and the Bishop's Court at Lismore prohibited him from laying on hands in the future. He seems to have disobeyed the court's injunctions. As is the case with so many quacks, he soon found titled victims. In January 1665-6 the Earl of Orrery brought him over to England in order that he might lay his hands upon the wife of Lord Conway, who suffered from chronic headaches. Although he was unsuccessful with this patient, he, nevertheless, seems to have performed cures in a number of persons that lived in her neighborhood, so much so that an account of his cures in Warwickshire was published by a Mr. Stubbe in which he stated "that Mr. Greatrakes was possessed of some peculiar temperament, as his body was composed of some particular ferments, the effluvia whereof being introduced, sometimes by a light, sometimes by a violent friction, restore the temperament of the debilitated parts, regenerate the blood, and dissipate the heterogeneous ferments out of the bodies of the diseases, by the eyes, nose, mouth, hands, and feet." Stubbe's account was written in the form of a letter to the famous Robert Boyle, Esq. The latter was extremely put out at being made party to what he was at first disposed to regard as the performances of a quack, but *mirabile dictu,* after witnessing some eight laying on of hands, even the great Boyle succumbed and publicly announced that he could vouch for some of the wonderful results achieved by the healer.

This English visit marked the climax of Greatrake's career. He made large sums of money, but within a few years his fame declined as rapidly as it had risen, and he died in obscurity.

Queen Anne's poor eyesight rendered her a godsend to quack ophthalmologists. Two of these rascals the Queen especially delighted to honor. One was a tailor named William Reade whom she knighted. The other was a shoemaker, named Roger Grant. He was made oculist to the queen by special appointment. The champion quack ophthalmologist of the eighteenth century, however, was undoubtedly the Chevalier John Taylor. Dr. Brown Pusey, of Chicago,[2] has recently published an account of his career founded upon his biography which was published in London in 1761, with the following title:

"The Life and Extraordinary History of the Chevalier, John Taylor, Ophthalmiator, Pontifical, Imperial and Royal; in two volumes; written from authentic materials and published by his son, John Taylor, Oculist; London, 1761." Dr. Pusey truly says, "in comparison with him the quacks of the present day are a cheap lot." Dr. Pusey gives extracts from the hand bills which it was his wont to distribute, and their glowing eloquence puts to shame all modern imitators. In the course of his book, he narrated the tremendous distances he had travelled, and the vast experience he had had. He was appointed Ophthalmiator Pontifical by Pope Benedict XIV, and was appointed oculist to George II, King of England, Augustus III, King of Poland, Frederick V, King of Denmark and Norway, Frederick Adolphus, King of Sweden. As Dr. Pusey says one of his important cases was in the person of a man who seems nearer to us than all these high personages, namely Handel, of whom he says, "I once thought to have had the same success, having all circumstances in his favor, motions of the pupil, light, etc., but on drawing the curtain, we found the bottom defective."

His son followed in his footsteps as a quack oculist, and although he did not achieve as wide a reputation as the father, he was probably more successful from a pecuniary point of view, achieving a large practice which he kept until the end of his days.

Goddard's Drops.

There have been quacks whose fame was based upon some nostrum, the recipe for which has since been revealed to the world, and in some instances the preparation is still in use, generally with modifications, or under a different name. Thus we seldom realize nowadays when we prescribe Aromatic Spirits of Ammonia that they were originally famous as a secret preparation known by the name of "Goddard's Drops." They were originated by Dr. Jonathan Goddard, a fellow of the Royal Society, and Professor of Medicine in Gresham College. Dr. Goddard had a large practice, and was a professional adviser as well as an intimate friend of Oliver Cromwell. He had a laboratory in Gresham College in which he manufactured various medicinal preparations, of which the drops became the most famous. He for some time kept their manufacture a secret, and sold them through apothecaries but as this was contrary to his oath to the College of Physicians, he was obliged to reveal his secret to them, but only did so upon their promise that the recipe should not be published until after his death. They were at first known as Spiritus Salis Volatalis Oleosus, or Sal Volatile Drops. In "Doctors and Doctors" by Graham Everitt, there is a quotation from the Sloane MSS. 958, in which there is an entry, in a memorandum book, in the handwriting of John Coniers, an apothecary on Shoe Lane which reads as follows:

"March 24, 1674-5. About ten o'clock that night my very good friend, Dr. Jonathan Goddard, reader of the physic lectures at Gresham College, suddenly fell down dead in the street, as he was entering a coach. He was a pretty corpulent and tall man, a bachelor between 45 and 50 years of age; he was melancholy, inclined to be cynical, and used now and then to complain of giddiness in his head. He was an excellent mathematician, and some time physician to Oliver the Protector."

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[2] Journal of the American Medical Association, November 7, 1903.

Spot Ward.

Another substance which is now in general use, but of which the nature was at first kept secret by its inventor, is oil of vitriol, or oil of sulphur. Joshua Ward, its discoverer, derived his nickname "Spot" Ward from a facial blemish. He was originally a chemist, and in the course of his work discovered a method of making oil of sulphur by the combustion of sulphur with saltpeter, the resulting compound being so cheap in its manufacture, that it soon completely supplanted the real oil of vitriol in the market. Ward was a thorough going quack, and employed every precaution to prevent the discovery of the nature of the substance which he used. He was a large, fat man, and used to drive around in a magnificent chariot drawn by four horses. He was high in the favor of George II, who provided him with a sort of dispensary and office in White Hall at which he attended the poor and gave them his medicines for nothing at the expense of the king.

Upon one occasion, when he had been paying a professional visit to his majesty, he turned his back on the king in leaving the room and started for the door. A court officer stepped forward and reminded him in a whisper that he should not turn his back on the king, to which he replied in a loud voice "The king's seeing of my back is a matter of no consequence, but the breaking of my neck falling backwards is of consequence not only to him but to the poor."[3]

Lady Mary W. Montague refers to Ward's preparation in a letter of 1748, and adds to it one of her usual keen reflections. "I find," she says, "that tar-water has succeeded to Ward's drops; and it is possible that some other form of quackery has by this time taken place of that. The English are, more than any other nation, infatuated by the prospect of universal medicine."

John St. John Long.

John St. John Long deserves to be ranked among the most successful quacks of all time. From his practice he is said to have derived an income of over £13,000 a year, and fortunately for him, death terminated his career at a time when many victims cherished a belief that he was the greatest of healers. He was the son of a poor Irish peasant, and passed his youth in the village of Doneraile. He was possessed of a natural talent for drawing and painting, and after passing a short time in Dublin, in the cultivation of these gifts, he established himself as an artist in Limerick. Here he painted portraits and gave instructions in painting and drawing to such pupils as he could procure. Finding the village of Limerick somewhat limited as a sphere for his activity, Long migrated to London where he worked for some time in the studio of Sir Thomas Lawrence. During this time he turned a few honest shillings by making anatomical drawings and paintings for the professors in the London Medical Schools. In the course of his work, he picked up some crumbs of medical knowledge, and soon announced that he had discovered a wonderful liniment by means of which he was not only able to cure most diseases, but also to discover the existence of latent disease in various organs. If, for example, this substance were applied over the chest of any person if they were healthy, and if there was no phthisical or other affection of the lungs, the application would be absolutely void of result. If, however, the lungs were in any way diseased, the substance would produce a counter irritation resulting in the formation of a weeping sore. The acrid substance which flowed from this, Long said was the essence of the disease. His enemies claimed that he used two distinct fluids to effect this wonderful result, one a bland and innoxious substance, the other a blistering liquid which originally bore the name of St. John Long's liniment.

In a footnote in the United States Pharmacopeia, the following instructions are given for making the latter:

"Take the yolk of one egg, 5 fluidrachms of acetic acid, 3 fluidounces of oil of turpentine, $2\frac{1}{2}$ fluidrachms of rose water, and $\frac{1}{2}$ fluidrachm of oil of lemon. Make an emulsion."

He also had a remedy in the form of vapor which was to be inhaled. For this purpose his patients would seat themselves around a large cabinet from which radiated a number of stems, through which they inhaled the vapor. Long fitted up magnificent offices in a mansion in Harley Street, and here the aristocracy flocked in swarms to inhale and to be rubbed. The list of Long's patients reads like a directory to the fashionable quarter of London. But not only was he patronized by the citizens of the metropolis, but the sick and the foolish flocked from every quarter of the United Kingdom. The contemporary accounts of some of the scenes in Long's offices, whether written by his friends or his enemies, are most amusing. It was only possible for him to see patients for a few moments, and he would then turn them over to one of his assistants, or else send them into the inhalation room to join the other patients sucking the miraculous vapor through Long's tubes.

Long seems to have had a most attractive personality. He was tall and well built, with a handsome face and agreeable manners. He lost no opportunity to ingratiate himself with his fashionable clientèle, and was soon a very welcome guest in some of the most fashionable houses in London. Particularly was he a favorite with the ladies, and more than one noble female is said to have offered him an opportunity to improve his fortunes by contracting a matrimonial alliance with her. It deserves to be recorded to his credit that no hint of scandalous relations was ever breathed against him, although his enemies would only have been too glad to have availed themselves of an opportunity to cast aspersions upon his character. Upon Long's death it was found that he left a widow in Ireland which accounted for the firmness with which he rejected the advances of other ladies.

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[3] Professional Anecdotes or Ana of Medical Literature, London, 1825.

One way in which he enormously increased his practice was to persuade healthy persons that he saw indications of latent disease within their systems, which could be demonstrated by an application of his wonderful liniment. As most of his patients were accompanied by various female relatives and friends on their visits to his office it was very easy for Long to cast his net about the healthy while bestowing his professional attentions upon the sick. As we shall see, it was this trick of Long's which got him into his first serious encounter with the law when he practiced it upon the sister of a young Irish girl whom he was attending for phthisis.

In 1829, Long wrote a book which he published with the following title:

"Discoveries in the Science and Art of Healing. By John St. John Long, Esq., M. R. S. L., together with the evidence upon which the author claims the confidence of the country, etc., etc."

The front page was adorned with quotations from Lord Bacon and Sir Astley Cooper. The book was dedicated to Sir Richard Paul Jodrell, Bart., and in the course of a lengthy epistle to that nobleman, the wily author introduced a letter from Lord Ingestre. In the introduction he stated that the object of his work was "to lay before the Public the successful results of my researches on some of the more important diseases of the human frame, particularly in the cure of consumption and mania, and prevention of the fatal consequences of small-pox, measles, whooping-cough, or other analogous inflammable disorders to which I shall subjoin my reasons for departing from the established rules of medical practice." He claimed that he could show that all these various deviations from health were the result of presence of a "certain acrid matter or fluid pervading the system while in a state of disease." The book was also designed "to submit the documentary evidence upon which I claim the confidence of the country." Long affirms that no one can deny that in cases of illness, medicines of a poisonous and deleterious quality are frequently administered. He very judiciously quotes in a footnote a statement of Hunter, "We find that new diseases arise from mercury alone. The tonsils shall swell where no disease has been before. The periosteum shall thicken and also probably the bones, and the parts over these shall become œdematous and sore to the touch." Long's method of applying quotations is very similar to that of the man who pointed to the fact that the bible contained the assertion "There is no God," omitting the reference to the preceding verse, "The fool hath said in his heart," Mr. Long then wisely asks "what healthful union can there be between mercury, prussic acid, henbane, digitalis, acetate of lead, sulphuric acid, nitrous acid, and flesh and blood?" Having thus challenged the medical profession, Long proceeds to a series of observations on the origin of consumption and other diseases. This section consists in an exposition of his views concerning the "acrid matter" which is most amusing. He nowhere makes any attempt to explain the nature of this acrid matter, but confines himself to the dogmatic statement that practically every disease is the result of its presence. Thus he states "This acrid matter is inherent in the human frame, and is first apparent under the form of small-pox and measles, etc. The susceptibility to these diseases originates with men's existence, and according to circumstances is operated on, and brought into action at different ages. But although many persons may altogether escape exhibiting the usual external symptoms, yet the peccant substance is more or less in the system. In those cases, a portion of the acrid matter must have exuded from the system, still leaving a sufficient quantity to operate in future time, and under a new form."

In regard to cholera, diarrhœa and dysenteric affections he states, "My power over this class of diseases is so great, that I am desirous of communicating the knowledge to the Honourable the East India Company. I shall be happy to show them the control I possess over every species of intestinal irritation; and over maladies that may in their worst states and stages immediately be cured. So simple is the process, that every individual in India may always carry the remedies about his person, so as to use them at the moment of the attack." In the same manner such varied infections as liver complaints, gout, cataract, deafness, erysipelas, ring-worm are all of them claimed to yield readily upon Dr. Long's wonderful remedy extracting the acrid matter from the constitution.

In the treatment of insanity to which the next section of the book is devoted, Long claims to have been particularly successful. The following chapter is devoted to an outline of his general method of treatment. He states that his general practice consists of applications and certain fumigations so innoxious and gentle in their nature, that they may be employed either by himself or by the patients without producing any unpleasant effects whatsoever. In this section there are one or two judicious quotations from Hippocrates.

The concluding section of the work is composed of letters from grateful victims. They possess a wonderful resemblance to that chapter of the "Key to Health and Science of the Scriptures" which Mrs. Eddy has entitled "Fruitage," which an irreverent reader has suggested should be read "Easy Fruitage."

On Saturday, October 30, 1830, Long was brought to trial at Old Bailey charged with manslaughter in occasioning the death of Catherine Cashin. He pleaded not guilty to the indictment. The facts elicited at his trial were as follows:

Miss Catherine Cashin was a young lady of good family in Ireland who had brought her younger sister up to London to be treated for phthisis. The elder sister, at the time of her arrival in London, was in perfect health. She had taken her sister a few times to Long's house, when the quack announced that he had discovered signs in her of latent consumption, and that if she did not put herself promptly under his care, she would develop the disease within two months. This frightened the young woman to such an extent that she agreed to place herself in his hands. Accordingly, on the 3rd of August, she went to his offices and was rubbed with the famous liniment between her shoulders and on her back. Within a short time the parts began to ulcerate and become gangrenous and she died on the 17th of the month. Before her death Mr., afterwards Sir Benjamin Brodie was called in and at the trial he gave it as his opinion that her death was the result of the mortified sore upon her back. At the autopsy there was no evidence of disease of any of the organs, save the large sloughing sore between the woman's shoulders. The woman employee of Long, who performed the actual rubbing on Miss Cashin's back, testified that she had rubbed the woman with the same lotion that had been used on a number of other persons, among them the Marchioness of Ormonde and Lady Harriet Butler. The wound was dressed with a cabbage leaf, and treated in a precisely similar manner to that of the other patients. A number of witnesses were called in in behalf of the prisoner, amongst them some of the best known people and of the very highest social standing in London. The judges charge was strongly in favor of the prisoner, though the jury found him guilty. His punishment, however, was not excessive, as he was only fined £250, which sum he pulled from his pocket in the court room. The account of the trial concludes, "having quitted the bar, he proceeded to the court yard in company with his friends, where they got into a curricle of the Marquis of Sligo and rode off with his Lordship amidst the clapping of his noble friends, and the hootings and hissing and laughter of the populace."

On November 10, 1830, Long was again brought before a coroner's jury, accused of manslaughter in having caused the death of Mrs. Colin Campbell Lloyd, the wife of a captain in the navy. Her medical attendant and surgeon named George Vance, stated that he had been called in to see Mrs. Lloyd, and found her suffering from a large sloughing sore, covering practically the entire front of her thorax, and extending down so far that the sternum was found bare. She stated that she had been rubbed twice at St. John Long's house with his liniment. Mr. Brodie who saw her stated that the appearance of the sore was exactly similar to that which he had found on the back of Miss Cashin. Another surgeon, a Mr. Campbell, testified that he had seen Mrs. Lloyd some days before she had consulted Dr. Long, and that she had been in perfect health. She had visited the quack with a view to procuring relief from a slight throat infection. After examining her, Long had informed her that the throat trouble arose from extensive disease of the lungs, they being full of small ulcers, and recommended his inhalation treatment in addition to applications of his liniment to her chest. Her husband likewise testified that she had been in perfectly good health until after the rubbings at Long's. At the autopsy, all Mrs. Lloyd's organs were perfectly normal, and the body showed no signs of disease, with the exception of the enormous sloughing sores over the chest and upper part of the abdomen. The jury found that the deceased had come to her death as the result of the application of a liniment to her chest by Dr. Long. When brought to the trial at the Old Bailey on the charge of having killed Mrs. Lloyd, the jury acquitted him.

Long's quackery was, of course, grist to the mill of Thomas Wakely, the editor of "The Lancet," and his editorials during the years 1830-31 upon the subject of St. John Long, and the legal procedings against him are most interesting reading. Amongst those who testified to the efficacy and safety of St. John Long's practice was Sir Francis Burdett, Bart., Wakely gives the following quaint narrative of the occasion of Burdett's resort to the quack. He writes: "The motive which induced Sir Francis Burdett to first visit Long has been thus explained. The honorable baronet is on terms of intimacy with the Marquis of Anglesea, who left the plains of Waterloo minus a leg. Sir Francis, keenly feeling for his friend's misfortune, having heard of the miraculous powers of the mystic "liquid" and having read probably that if the claw of a lobster be taken off, the energies of the animal are equal to the production of another claw, he applied, it is said to Long to know whether, if the "secret fluid" were gently "rubbed" over the skin of the stump, the marquis' leg and foot might not grow again? It is reported that although the leg and foot were not forthcoming, the operation was not entirely unproductive, having within a short period produced a great toe."

Among St. John Long's most ardent defenders was Dr. Ramadge, of Ely Place, London. He wrote a long letter addressed to Long, advocating his cause which was published in the London Sunday Times, on April 10, 1831, in which he stated that he had been at first an opponent of Long's but that after deep reflection he had changed his opinion. He claims that at the autopsy on Miss Cashin there were found distinct evidences of pulmonary disease, and that the severe effects produced by the liniment "occurred because she had overloaded her stomach with purple grapes and plums, causing febrile attacks, and thereby aggravating the sore on her back."

Wakely republishes Dr. Ramadge's letter in "The Lancet" of April 16, 1831, accompanying it by the most severe editorial comments on his unprofessional behavior, from which we would only quote the following:

"If, in short, it be possible for Dr. Ramadge to be the author of this letter, we advise him, forthwith, to abandon the ranks of a profession which he has disgraced, or most assuredly the members of the profession will abandon him."

In spite of all the expositions of Long's quackery which were published not only in the medical but in the lay press, he continued to be upheld by a large and influential clientêle. His career was terminated at the early age of 37 by phthisis pulmonalis, the very disease to which he had laid his most extravagant claims to cure. At his death it was found that as a result of his nefarious practice, he had accumulated a snug fortune which he left to his widow in Ireland. He was buried in Kensal Green Cemetery, and over his grave some of his admiring victims erected an elegant monument which bore the following unique inscription:

"It is the fate of most men
To have many enemies, and few friends.
This monumental pile
Is not intended to mark the career,
But to shew
How much its inhabitant was respected
By those who knew his worth,
And the benefits
Derived from his remedial discovery.
He is now at rest,
And far beyond the praises or censures
Of this world.
Stranger, as you respect the receptacle of the dead
(As one of the many who will rest here),
Read the name of
John Saint John Long
without comment."

Dr. Perkins.

Among successful American quacks the name of Elisha Perkins should always hold a preëminent position as the inventor of the famous Tractors which convulsed the medical profession not only in this country, but throughout the continent of Europe. He came of an eminently respectable New England family. His father, Joseph Perkins, was a native of Norwich, Conn., and his mother was a daughter of another physician of the same town, Dr. Caleb Bushnell. Dr. Joseph Perkins had graduated from Yale in 1727, being the first of thirty-six of that name who took their degrees at Yale College between 1727 and 1858. After graduating he studied medicine, and settled down to practice in his native town. He is said to have performed more capital operations than any other medical man in that part of the colony in Connecticut. He is frequently spoken of in contemporary articles as a man of brilliancy; he was also possessed of a pious disposition, a deacon in the church, and an enthusiastic worker in benevolent enterprises. He died in 1794, in the ninetieth year of his age. It is painful to think what must have been his reflections, if he were indeed a man of brilliancy and piety, upon the successful quackery of his son.

Elisha Perkins was born at Norwich, Conn., on January 16, 1741. He not only received his preliminary education from his father, but also studied at Yale. He received paternal instruction in medicine, and began his medical career by serving as his father's assistant. After devoting some years to medical practice in this capacity, he settled down to practice at Plainfield, Conn., where he rapidly acquired an extensive business. It is said that he frequently rode sixty miles a day on horseback in the course of his professional visits. He was well fitted for the work, being a man of remarkably vigorous constitution and great physical strength. He was above six feet in height, and excellently proportioned; he was accustomed to sleep but three or four hours in the twenty-four, and was a total abstainer. According to contemporary accounts, this paragon was of the most kind and sympathetic disposition. It is an unfortunate thing that most of our information concerning him is based upon eulogistic obituary notices, or derived from contemporary endorsements of his victims, two forms of biography which must give special pleasure to the Father of Lies. It is curious to find an account of Perkins inserted in the eminently respectable Thatcher's American Medical biography, and yet more strange to find that it consists chiefly of information derived from the glowing notices above mentioned, and dealing very gently with the element of quackery which entered so largely into its subject's practice.

In his son's pamphlet describing the Tractors, the following account is given of the way in which Dr. Perkins was first led to the discovery that there was an occult therapeutic property innate in certain metallic substances. "The first remarkable incident that presented itself to the notice of Dr. Perkins, was the sudden contraction of a muscle, when he was performing a chirurgical operation. This he observed regularly took place whenever the point of the metallic instrument was put in contact with the muscle. Struck with the novelty of the appearance, he was induced to try the points of wood, and other substances; and no contractions taking place on these experiments, he thence inferred that the phenomena could be ascribable only to the influence of the metal.

"About the same time he observed, that in one or two cases, a cessation of pain had ensued when a knife or lancet was applied to separate the gum from a tooth, preparatory to extracting it; and in the same year he discovered, that momentary ease was given in a few instances, by the accidental application of a metallic instrument to inflamed and painful tumours, previous to any incision." He then proceeds to describe how Dr. Elisha Perkins for some years experimented extensively with instruments made of various metals with the object of ascertaining more of their hidden properties, and as the son writes "The result corroborated and indeed exceeded his most sanguine expectations; for he discovered that, by drawing over the parts affected in particular directions certain instruments which he formed from metallic substances into certain shapes, he could remove rheumatism, gouty affections, pleurisies, inflammations in the eyes, erysipelas, and tetters; violent spasmodic convulsions, as epileptic fits; the locked jaw; the pain and swelling attending contusions; inflammatory tumours; the violent pains occasioned by a recent sprain; the painful effects of a burn or scald; pains in the head, teeth, ears, breast, side, back and limbs; and indeed most kinds of painful topical affections, which came under his care and observation. The instruments producing these effects are termed TRACTORS."

The instruments as finally made by Dr. Perkins consisted of two pieces of metal, about three inches in length, each pointed at one end, and in appearance greatly resembling horse shoe nails. They were utilized by drawing them gently over the part which it is desired to affect, the stroking generally lasting for some ten or twenty minutes at a time. A great deal of importance was attached to the treatment being carried out according to the printed instructions which were furnished with each pair, but it was most important of all that nothing but Dr. Perkins' Tractors should be used; no other pieces of metal would suffice, save those which were marked with the trade mark which guaranteed them genuine. They were retailed at five guineas a pair.

There is an amusing print by Gilray, representing a Perkinean doctor making an application of the Tractors to the pulpy red nose of an alcoholic Britisher. The victim seems to be in a most uncomfortable frame of mind; he is in an attitude expressive of the highest nervous tension. The doctor is steadying his head by holding his bald pate with one hand, having pushed his wig over his arm chair. John Bull's teeth and fists are clenched, and he is evidently in a terribly nervous state of apprehension, nevertheless, he has no intention of giving up his bad habits, for on the table beside him are brandy, sugar, lemon and hot water, all ready to be incorporated into a reeking punch. On the wall of the room we can just discern the fat legs of a little Bacchus, sitting astride a barrel. The apostle of Perkins is most intent upon his operation. He is applying but one of the Tractors, the other he holds between his teeth. We fear that Gilray would not have been a successful practitioner, as all the directions for their use distinctly state their valuable influence is exerted through the transmission of animal electricity from one tractor or pole to the other through the patient's tissues. It is probable, however, that the caricaturist purposely intended to misrepresent the method of application in this instance.

It is gratifying to learn that this delusion made less headway in America than it did when exploited in London and in other cities on the Continent. Elisha Perkins sent his son, Benjamin Douglas Perkins, abroad for the purpose of diffusing his propaganda in other lands. The success which he achieved is almost incredible. An institution which rejoiced in the name of The Perkinean Institution was founded in London under the presidency of Lord Rivers, the object of which was to furnish free treatment to the poor. Upon the list of those who endorsed the institution we find no less than eight professors of various branches of medicine and surgery, forty physicians and surgeons, and thirty clergymen. In Copenhagen the success of the Tractors was fully as great. The physicians on the staff of the Royal Frederick Hospital in that city published a long series of experiments with the Tractors, accompanied by reports of miraculous cures which had been wrought by their means.

In 1799 Benjamin Douglas Perkins, who was then residing in London, published a book entitled:

> "Experiments with the Metallic Tractors, in Rheumatic and Gouty Affections, Inflammations, and various Topical Diseases, published by Surgeons Herholdt and Rafn, of the Royal Academy of Sciences, Copenhagen; Translated into German by Professor Tode, Physician to his Danish Majesty, Thence to the English Language by Mr. Charles Kampfmuller; also Reports of about one hundred and fifty cases, in England, demonstrating the efficacy of the Metallic Practice, In a Variety of Complaints, both upon the Human Body, and on Horses, etc., By Medical and other Respectable characters. Edited by Benjamin Douglas Perkins, A. M., of Leicester-Square, London, Son of the Discoverer."

The last paragraph of the introduction is most ingeniously suggestive, it reads:

"The Tractors with printed Directions for their use in families, may be had of the Editor, at his house in Leicester Square, price Five Guineas the set.—To prevent frauds and impositions, every genuine set of the Tractors is stamped with the words 'PERKINS PATENT TRACTORS;' and to the paper of directions, attending them, is subjoined a receipt for the Five Guineas, numbered and signed in his handwriting; thus 'Benjamin Douglas Perkins.' The hours of attendance on Patients at home are from Nine to Three o'clock in the Morning, The remainder of the day is devoted to Patients abroad."

Benjamin Douglas Perkins in the same year also published, while still in London a pamphlet entitled:

> "The Influence of Metallic Tractors on the Human Body in Removing various painful Inflammatory Diseases, such as Rheumatism, Pleurisy, Some Gouty Affections, etc., etc., lately discovered by Dr. Perkins, of North America; and demonstrated in a series of Experiments and Observations, by Professors Meigs, Woodward, Rogers, etc., etc., by which the importance of the Discovery is fully ascertained, and a new field of Enquiry opened in the Modern Sciences of Galvanism, or Animal Electricity. By Benjamin Douglas Perkins, A. M. Son of the Discoverer."

The excitement which prevailed over this wonderful discovery lasted well into the first decade of the nineteenth century, but it then gradually subsided, and in a few years the Perkins' golden harvest was over. Thatcher, with characteristic conservatism concludes his account of Perkinism with the following paragraph:

"Such is the history of the Metallic Tractors. It is to be considered a singular and unaccountable circumstance that the remedy should have been consigned to oblivion. Is it within the bounds of probability that the vast amount of authenticated evidence that has been produced, should be resolved into a delusion, a mere phantom of the imagination? However enthusiastic the promoters of the novel discovery may have been, it is more clear that autoptical evidence was in every instance at command, and might have precluded the possibility of deception. If, therefore, Perkinism has shared the fate of Animal Magnetism, there is no sufficient reason for supposing that its discoverers should be placed in the same class with Mesmer, as he undoubtedly was a man of honorable principles and character."

It is interesting to read that while foreign nations were adding their tribute of homage to Perkinism, Elisha Perkins was expelled in 1797 from the Windham County Medical Society of which he had been a member, and in 1795 the chairman. In 1799 there was an epidemic of yellow fever in the city of New York. Elisha Perkins had some time before brought forward what he claimed was a specific remedy in the treatment of diphtheria, typhoid fever, and dysentery. The mixture consisted of sodium chloride dissolved in vinegar. This was diluted with hot water. Anxious to prove its efficacy, he hastened to the smitten city where he fell a victim to the disease, and died a few weeks after his arrival in the fifty-ninth year of his age. It was subsequently said of him, as of a more famous character in history, that nothing in his life became him so well as the leaving of it. We believe this to be an erroneous view, Perkins was a quack, pure and simple, and only went to New York with the idea of exploiting himself yet further in the public eye. As to his son, Benjamin Douglas, after graduating from Yale in 1797, he had gone to London to preach the doctrine of the Tractors. He accumulated an enormous fortune with which he returned to New York and opened up a bookstore in partnership with a man named Collins. In this enterprise, he proved very successful. Towards the latter part of his life, his religiosity became very prominent, and he became a strict quaker. Thatcher says: "He sustained a character of inestimable worth; was frank, honorable and discrete; in morals exemplary; in religion undissembling and devout."

Among the letters contained in the book which Benjamin Douglas Perkins edited, was one from John Vaughan, M. D., M. P. M. S., in which he narrated some wonderful cures effected by the use of the Tractors and the book also contains a letter from John Tilton, President of the Medical Society in the State of Delaware, which contains the following remarkable statement:

"I am glad you have at length overcome the restraints of diffidence, by giving us your thoughts on Electricity, in explanation of Dr. Perkins' Metallic Operation. That some general principle exists, which gives metals a powerful influence on the animal economy, is now universally acknowledged by philosophers the most candid and best qualified to judge. Instead of involving Dr. Perkins in the disgrace of Mesmer, I apprehend we ought rather to contrast the honest man with the rogue; for, without art or affectation, Dr. Perkins barely discloses useful facts, by means the most simple and easy.

It must be confessed, however, that many reject our general principle: like infidels to the gospel, they admit of no mysteries, and refuse to believe what they do not readily comprehend. Others who acknowledge that a general principle pervades the animal economy, on which the metals have influence, nevertheless, dispute about what this notable power may be. Both these classes of men ought to thank you. To the one you have given a reason they did not apprehend, and the other should wish for the best account known or well understood. For my part, I frankly confess, I shall be satisfied with the principle of ANIMAL ELECTRICITY, until the Phenomena are better explained by means of some other."

Tilton was one of the foremost physicians of his time. He was a graduate of the first medical class in the University of Pennsylvania, and had been offered the chair of Materia Medica in that institution. He had had an honorable career as an army surgeon during the Revolutionary war, and wrote a very valuable little book entitled "Observations on Military Hospitals," and in the war of 1812, he was physician and surgeon-general in the United States Army. It is not much wonder that the Perkineans were delighted to obtain anything like an endorsement from such a man, and it is no wonder that if Dr. Tilton was inclined to think there was some value in the metallic Tractors, other persons should be deceived.

ON THE CARDIAC AND VASCULAR COMPLICATIONS AND SEQUELS OF TYPHOID FEVER.

THE JEROME COCHRAN LECTURE.[1]

By William Sydney Thayer, M. D.,

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I. Introductory Remarks.

On receiving your very kind invitation to speak before you to-day, it seemed to me that the most profitable subject to discuss would be that in the study of which I was at the moment engaged, the cardiac and vascular complications and sequels of typhoid fever.

A glance at the extensive literature concerning this question cannot fail to impress one with the considerable variance of opinion existing between different observers as to the frequency and extent to which the heart and vessels suffer in this malady.

(1) The Heart.

(a) *Endocarditis.*—Concerning the frequency of endocarditis as a complication of typhoid fever there is little difference of opinion. Most observers agree in regarding it as a rare and unimportant complication. Among the 2000 Munich necropsies[2] there were but 11 instances of endocarditis. Girode,[3]

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[1] Delivered before the Alabama State Medical Association at Mobile on April 20, 1904, and published in the Mobile Medical and Surgical Journal for July, 1904.

[2] Hölscher: München. med. Wchnschr., 1891, XXXVIII, 43, 62.

[3] Bull. méd., 1889, III, 1392.

Viti,[4] Carbone,[5] and Vincent,[6] have obtained typhoid bacilli from endocarditic vegetations and Lion,[7] has produced experimentally, an endocarditis of the aortic valves in rabbits after intra-venous injection of typhoid cultures. The majority, however, of the cases of endocarditis which occur as complications of typhoid fever are probably the result of secondary infection.

(b) *Pericarditis.*—The same is true—to an even greater extent—of pericarditis.

(c) *Myocarditis.*—With regard to the myocardial changes, there is a most extensive literature dating from the early part of the last century. The recent investigations of Romberg,[8] Landouzy and Siredey,[9] Renaut,[10] Mollard and Régaud,[11] [12] Giacomelli[13] and others have shown clearly that in some instances the changes may be sufficient to play a grave part in determining the fatal result of the disease. Moreover, the extent of these lesions is sometimes such that it can scarcely be doubted that in cases which recover, grave sequels must appear in after years. Great differences of opinion, however, exist both as to the relative frequency of acute myocarditis, its relation to the clinical manifestations of the disease and the frequency with which it results in serious permanent damage to the heart.

What clinical symptoms justify us in assuming the existence of an acute myocarditis?

How often does typhoid fever result in permanent damage to the heart?

These are questions with regard to which there is the widest difference of opinion.

It must be acknowledged that this disease has not in the past been regarded as an important agent in the production of chronic cardiac or vascular defects. A few observers, however, have been outspoken in their opinion that typhoid fever has an influence of real significance in the production of acute and chronic myocarditis. Chief among these have been Landouzy and Siredey and Mollard and Régaud.

The emphasis which the first of these observers places upon the effect of typhoid fever upon the heart and vessels is strikingly shown by the following words from a communication made some eighteen years ago.[14] "The day when hygiene shall prevent typhoid fever, it will not only save from death each year more than one thousand Parisians, it will save more than a thousand individuals from disease of various systems, especially from diseases of the heart, that is, it will save each year at least a thousand invalids."

These are striking words. Are they justified by fact? There are in literature few, if any, systematic clinical observations with regard to the point.

(2) The Arteries.

A survey of the literature with regard to affections of the arteries in typhoid fever is of considerable interest. Little attention has been paid in this country to the occurrence or significance of acute arteritis in typhoid fever, to its influence upon the course of the disease or to its later sequels. The chapter on typhoid arteritis and arterial thrombosis in most text-books on typhoid fever is extremely short; yet there is a large and interesting literature upon the subject.[15] Gangrene of the extremities has long been recognized as an occasional complication of the disease and the fact that this is in many instances due to autochthonous thrombosis associated with an acute arteritis has also been pointed out.

That acute endarteritis may occur in the aorta and smaller arteries in connection with typhoid fever as well as in other acute infections is mentioned by many observers, and yet its extent, its frequency, its possible influence in determining grave local or general disturbances in later years, have not to my knowledge been systematically investigated.

Curschmann[16] in his recent work says: "I would emphasize expressly that in a large number of post-mortem examinations in cases of typhoid fever in which I have noted the condition of the coronary arteries I have never found these diseased"—a statement considerably at variance with our experience.

(3) The Veins.

With regard to the venous complications of typhoid fever much more has been written and much more is known. The venous thromboses so frequent especially in the lower extremities, which since the time of Virchow, have been regarded as essentially marantic, are now again more generally considered as secondary to an actual phlebitis due in some instances to the typhoid bacilli alone, in others to secondary, mixed infections. Haushalter,[17] obtained typhoid bacilli in pure culture from the inflamed wall of the femoral vein, and was able to demonstrate them locally in the external coat of the vessel.

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[4] Atti d. r. Accad. d. fisiocrit. di Siena, 1890, 4 S., II, 109.

[5] Gaz. med. di Torino, 1891, XLII, 122.

[6] Mercredi méd., 1892, III, 130.

[7] Essai sur la nature des endocardites infectieuses. 4°, Par., 1890.

[8] Uber die Erkrankungen des Herzmuskels bei Typhus abdominalis, Scharlach und Diphtherie. Deutsch. Arch. f. klin. Med., 1891, XLVIII, 369; 1892, XLIX, 413.

[9] Contribution à l'histoire de l'artérite typhoïdique; de ses conséquences hâtives (mort subite) et tardives (myocardite scléreuse) du cœur. Rev. de méd., Paris, 1885, V, 843. Landouzy: La fièvre typhoïde dans ses rapports avec l'appareil vasculaire et cardiaque. Gaz. d. hôp., Paris, 1886, LIX, 323. Landouzy et Siredey: Etude sur les localizations angiocardiaques typhoïdiques, leurs conséquences immediates, prochaines et éloignées. Rev. de méd., Paris, 1887, VII, 804, 919.

[10] Les myocardites aiguës. Congrès Français de médecine. V. session, Lille, 1899; Paris, 1899, II, 1-83.

[11] Etat des artères du cœur dans les myocardites aiguës. Congrès Français de méd., 1899, V, 280.

[12] Les troubles cardiaques dans la convalescence de la fièvre typhoïde. Presse méd., Paris, 1900, I, 19-22.

[13] Il miocardio nelle infezioni, intossicazioni, avvelenamenti. Ricerche anatomo-patologiche e sperimentali, Policlinico. Roma, 1901, VIII, M., 145-155.

[14] Landouzy: *Op. cit.*, 1886.

[15] For references see: Thayer. On Arteritis and Arterial Thrombosis in Typhoid Fever. The New York State Journal of Medicine, 1903, III, 21.

[16] Curschmann: Der Unterleibstyphus. 8°. Wien, 1898.

In such cases it has been generally assumed that the exciting cause of the thrombosis was afforded by the mechanical effect of actual anatomical lesions in the vessel wall. That other influences than purely mechanical changes in the wall may play an important part in inducing thrombosis in both arteritis and phlebitis has been shown by Flexner[18] and others and is borne out by my own observations.[19]

* * *

In view of these facts, it occurred to me that light upon some of the unsettled points might be obtained by a study of the material which has accumulated in the last fourteen and a half years in the clinic of Professor Osler at the Johns Hopkins Hospital and in the laboratory of the Pathological Department.

The plan which I laid out for myself was as follows:

(1) A study of the clinical records with regard especially to the cardiac and vascular symptoms and complications.

(2) A consideration of the anatomical records of those fatal cases in which necropsies were made.

(3) An investigation into the condition of as many of our old patients as could be examined.

At the outset I quite realized that the fulfilling of this whole task which should involve a careful histological study of our anatomical material, was more than could be accomplished in the time at my disposal. It has, however, seemed to me that an analysis of the question from a standpoint of clinical observation and a study of the gross pathological lesions could not fail to reveal facts of value and importance. These considerations I have the honor to present to you to-day.

II. General Clinical Analysis.

In the period between the fifteenth of May, 1899, and the first of January, 1904, there were admitted to the Johns Hopkins Hospital, 1458 cases of typhoid fever.

Of these 132 or 9.05 per cent died.

This rather high percentage is due to the fact that a considerable number of cases were brought to the hospital in a practically moribund condition.

In analyzing the clinical records of these cases, most of which I have had the good fortune to observe personally, I have selected for consideration those of the common cardiovascular manifestations which might be regarded as *possibly* indicative of actual anatomical involvement of the heart or vessels, as well as the more definite vascular complications.

(1) The Pulse.

(a) *Rapidity.*—Of these 1458 cases there were 220 or 15 per cent in which the pulse was above 140. 46 of these patients were under 15 years of age.

Of the 174 cases above fifteen years of age, 86 or nearly 50 per cent, resulted fatally.

77 cases showed a pulse of over 150; of these 55 or 71.4 per cent resulted fatally.

In 51 cases there was a registered pulse of above 160, with a mortality of 35 or 78 per cent.

In 6 cases there was a pulse above 170; two-thirds of these were fatal.

In 2 instances a pulse of 180 or above was recorded; one of these recovered.

In 2 instances the pulse was uncountable; both patients died.

(b) *Bradycardia.*—In 117 cases a pulse rate below 50 was noted. In all of these instances the bradycardia was a feature of convalescence. In one case only did a relapse follow.

In 6 cases a pulse below 40 was noted; the lowest recorded pulse rate—observed in two cases,—was 35.

All these 117 patients recovered. This circumstance when considered in connection with the fact that eight of these patients examined at periods varying from five months to eight years after their illness, showed no cardio-vascular defects, justifies the conclusion that the bradycardia of convalescence is of little or no prognostic significance.

(c) *Arhythmia.*—Irregularity,[20] of the pulse was noted in 29 instances, of which 10 resulted fatally.

In many of these cases the irregularity was associated with extremely rapid action of the heart and grave general symptoms.

Of 13 instances where the pulse was above 140, 9 or 69.2 per cent ended fatally.

In the remaining 16 cases, the irregularity was noted in several instances at the height of the disease; one of these resulted fatally. In the majority of cases, however, it was a feature of convalescence, being associated in 4 instances with a pulse of under 50.

(2) Heart Sounds.

Of the 1458 cases the heart sounds were clear throughout in 1125 patients. In 333 instances, or 22.8 per cent of the cases, cardiac murmurs were heard at one time or another.

In sixteen patients the murmurs were regarded as evidence of pre-existing valvular disease of the heart.

The lesions in these cases were as follows:

Mitral insufficiency	10
Mitral insufficiency and adherent pericardium	1
Mitral stenosis	2
Mitral stenosis and insufficiency	1
Aortic insufficiency	2
	16

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[17] Phlegmasia alba dolens et bacille typhique dans la fièvre typhoïde. Mercredi méd., 1893, IV, 126.

[18] Univ. of Pennsylvania Med. Bull., 1902, XV, 324.

[19] Thayer: On Arteritis and Arterial Thrombosis in Typhoid Fever. The New York State Journal of Medicine, 1903, III, 21.

[20] It is evident from the remarkably low figures that only instances of rather striking irregularity were recorded.

In addition to these cases there was one instance of Graves' disease with tachycardia and a systolic murmur at the apex.

Of the sixteen cases of valvular disease of the heart but 2 or 12.5 per cent died.

In the remaining 316 cases the murmur was systolic in 312 instances, diastolic once, while in 3 cases both systolic and diastolic murmurs were audible.

ANALYSIS OF THE CASES IN WHICH SYSTOLIC MURMURS ALONE WERE HEARD.

Out of the 315 cases in which systolic murmurs were heard, there were two in which the record as to the localization of the murmurs was not satisfactory.

In the remaining 313 cases the murmur was heard:

At the apex alone in	87	cases.
At all four orifices in	66	"
At the apex, tricuspid and pulmonic areas in	49	"
At the pulmonic area alone in	35	"
At the aortic and pulmonic areas in	21	"
At the pulmonic area and apex in	20	"
At the apex, pulmonic and aortic areas in	11	"
At the apex and tricuspid areas in	9	"
At the pulmonic and tricuspid areas in	7	"
At the aortic, pulmonic and tricuspid areas in	4	"
At the aortic area alone in	1	"
At the apex and aortic areas in	1	"
At the tricuspid area alone in	1	"
At the apex, aortic and tricuspid areas in	1	"
	313	"

CASES IN WHICH THE SYSTOLIC MURMUR WAS HEARD AT THE APEX.

There were 244 cases in which the systolic murmur was heard at the apex of the heart.

In 56 of these cases it was transmitted outward as far as the anterior axillary line.

In but one case was it noted that the murmur was audible in the back.

TIME AT WHICH THE SYSTOLIC MURMUR AT THE APEX WAS FIRST OBSERVED.

In all of these cases the most detailed note was made usually upon admission to the hospital or within the several following days. Unfortunately, in many instances, careful notes upon the heart were not made later, and only in a rather small fraction of the cases was there a final record upon the day of discharge. It is, therefore, impossible to say with accuracy at just what period in the disease the murmurs developed. As a result of the fact that the first note was usually the most careful, the proportion of cases in which the murmur was audible on entrance is probably unduly high.

This was the case in 199 of the 244 cases.

The period of the disease at which the systolic murmur at the apex was first noted is illustrated by the following table:

TABLE I.

Illustrating the Period at which the Systolic Murmur at the Apex was First Observed.

WEEKS.

Prodromal period,	1st,	2nd,	3rd,	4th,	5th,	6th,	7th,	8th,	9th,	10th,	?	Total
2	78	92	38	22	4	1	2	3	0	1	1	244

The table shows, as one might expect, that apical systolic murmurs are present with the greatest frequency during the height of the disease.

The following table shows the time of development of the murmur in 45 cases in which an apical systolic murmur, absent on admission, appeared later in the course of the disease.

TABLE II.

Showing the Time of Development of the Apical Systolic Murmur in 45 Cases in which, on Entrance, the Heart Sounds were Clear.

WEEKS.

1st,	2nd,	3rd,	4th,	5th,	6th,	7th,	8th,	9th,	10th	
6	11	9	11	2	1	2	2	0	1	45

The figures in this table are closely similar to those preceding. The slightly greater prevalence of murmurs in the first weeks in Table I is doubtless due to the more careful initial examinations as observed above.

Of the 244 cases in which an apical systolic murmur was heard, this murmur disappeared before discharge in 107 instances; it was present upon discharge in 31 [21] cases; there was no note in 106 cases.

Of the 45 cases in which the systolic murmur at the apex developed in the hospital this murmur disappeared on or before discharge in 17 cases; it was present on discharge in 10 cases; there was no final note in 13 cases.

CHARACTER OF THE MURMUR IN THOSE CASES IN WHICH IT PERSISTED UPON DISCHARGE FROM THE HOSPITAL.

In the 31 cases in which an apical systolic murmur was observed during the attack persisting in some form on discharge the murmur remained at the apex in 28 instances; in one instance it was audible only in the pulmonic area; in one, in the aortic, and in one, at both areas at the base.

In 2 of the 28 cases where the apical murmur persisted on discharge, the sound was louder at the base; in 1 instance it was louder over the right ventricle; once it was loudest in the aortic area—a clear case of aortic stenosis. Two further cases left rather early in the course of the disease on the day on which the note was made. In 3 cases the murmur on discharge was transmitted to the axilla.

In 10 cases a systolic murmur at the apex developed after admission to the hospital and persisted in the same area at the time of discharge; in one of these instances, however, it was more marked in the pulmonic area.

There can be little doubt that the cause of these apical systolic murmurs is to be sought, in the majority of cases, in the relaxation of the heart muscle with consequent dilatation of the mitral ring. But the possibility that a certain proportion may be instances of endocarditis must not be lost sight of. The fact which will be mentioned shortly, that out of 132 necropsies there have been three instances of acute endocarditis, all unsuspected *intra vitam*, should be sufficient to convince one of the necessity of considering this possibility in every instance where cardiac murmurs persist after recovery from typhoid fever.

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[21] In one of these instances the patient left on the day of entrance.

The recognition of this fact should suggest to the physician the wisdom of keeping old typhoid patients under observation during a considerable period following the disease just as in the case of maladies more commonly associated with endocarditis.

Basic Systolic Murmurs.

The cause of the basic systolic murmurs can hardly be discussed at length in a communication of this nature. Their frequency and slight prognostic significance are well known. One may, perhaps, recall the happy comment made, I think, by Broadbent, who after considering the anatomical and physiological relations of the aortic and pulmonic orifices, observed that it is not the fact that systolic murmurs are so frequently heard in these regions that is remarkable; it is rather that they are not always present.

In but one case (No. 44724), was the basic systolic murmur regarded as indicative of organic lesion. This was a clear example of aortic stenosis.

Diastolic Murmurs.

In 4 instances (Nos. 4020, 18118, 36484 and 41270), diastolic murmurs were audible.

Case I (No. 4020). The first case was that of a man, 20 years of age, without history of previous illness. On entrance a faint systolic whiff was heard at the pulmonic cartilage. The case was one of considerable severity. On the 27th day of his illness a soft diastolic murmur was heard in the third left space at the sternal border. Two days later the following note was made: "The diastolic murmur noted the other day is very audible in the second and third interspaces, not at the aortic cartilage. There is a soft systolic just within the apex." The patient made a slow but complete recovery; unfortunately no further notes were made on his heart. It has been impossible to trace the subsequent history.

Case II (No. 18118). The second case was that of a man of 19 who entered the hospital on the eighth day of a severe typhoid fever; on entrance his heart sounds were clear. On the twelfth day Dr. Osler noted that a soft bruit was heard along the left sternal border. On the 18th day, with a very rapid pulse, a soft diastolic murmur was heard at the aortic cartilage. Unfortunately, no further note was made upon the heart. The patient died four days later, of perforation. At necropsy no abnormalities were noted in the aortic valves. The heart muscle was described as opaque.

Case III (No. 36484). The third case was that of a young man of 22 with no history of previous illness excepting for an attack of typhoid fever five years before admission; on the eighth day of a typhoid fever of moderate intensity, a short, sharp murmur followed the second aortic sound and was transmitted downwards along the sternal margin. Five days later it was noted that the second sound was rather indefinite and "murmurish" at the aortic area, though no positive murmur was audible. A distinct systolic murmur was heard over the body of the heart and in the pulmonic area, fainter in the second right space. The patient made an uneventful recovery. No further note was made upon the heart.

Case IV (No. 41270). A man of 40, who had had rheumatism 23 years before, developed, on the 11th day of a mild typhoid fever, an apical systolic murmur, and on the 14th day, a diastolic, heard along the left sternal border, both of which cleared up before discharge. The apex, however, moved outward 2.5 cm.

In a very large number of cases in which a systolic murmur at the apex was not noted it is mentioned in the history that, at the height of the disease, the first sound was "murmurish," "feeble," "blurred," "indistinct" or "indefinite." Later, however, in all of these cases in which a note was made, the condition of the heart sounds was found to be normal.

In a number of instances reduplications of the first and second sounds were recorded but sufficient attention was not paid to the study of reduplications to justify any conclusions.

(3) Pericarditis.

There were but 2 instances of pericarditis among these 1458 cases.

Case V (No. 24135). The first case was that of a man of 20 who, on the 26th day of a rather severe typhoid fever, with pronounced nervous symptoms—delirium, subsultus, general tremor—showed, just outside the point of maximum impulse, a very distinct to-and-fro friction rub. For several days this increased in intensity and then gradually disappeared. The patient made an uneventful recovery.

Case VI (No. 30666). The second case was that of a colored man 23 years of age. Early on the morning of the 25th day of his disease, after a tub, the patient began to complain of pain in the præcordial area and in the right upper chest. A well-marked pericardial friction rub was audible, though no definite endocardial murmur could be made out. The patient grew rapidly weaker; an audible and palpable friction rub developed in the lower axilla and back, death following within twenty-four hours

The necropsy showed, beside the lesions of typhoid fever, a fibrino-purulent pericarditis, due to the softening of tuberculous bronchial lymph glands and perforation of the trachea, œsophagus and pericardium. The typhoid bacillus was obtained on culture from the pericardium, bile and spleen.

Case VII (No. 45535). A third case of pericarditis complicating typhoid fever is at present in the hospital.

The patient, a woman aged 29, entered the ward toward the end of the first week of the disease. Four days before she had been seized with a stabbing pain in the region of the heart and a sense of palpitation. On entrance there was a systolic murmur in the pulmonic area and a well-marked to-and-fro pericardial friction rub in the præcordial region. No pleural friction rub was audible. Several days later evidences of a patch of bronchopneumonia were to be detected in the left axilla. The cardiac dulness increased, and the heart sounds became more muffled. Gradually, however, in the course of two weeks, the friction murmur entirely disappeared. The cardiac dulness diminished, the areas of pulmonary consolidation cleared up, and at the present day the patient is in full convalescence.

(4) Endocarditis.

Three cases of endocarditis have been discovered at necropsy. None of these were recognized *intra vitam*. In addition, there were several cases in which endocarditis has been suspected clinically.

Case VIII (No. 10131). The first case has already been reported by Dr. Osler.[22] A. C., a colored girl of 20, was admitted to the hospital on the 7th day of her disease. Just before admission the patient had had several bloody stools, and within two hours after entry there were five more which consisted almost entirely of blood. The heart's action was rapid, the sounds clear. There was a suggestion of embryocardia. The patient's condition, which was very grave on entry, did not change for the better and she died on the following afternoon.

At the necropsy, beside the lesions of typhoid fever, it was noted that the heart was not enlarged. "All the valves were normal except the mitral. Along the edges of the leaflets of this valve are a number of translucent vegetations varying in size from the head of a pin to four or five times that bulk. These are comparatively recent. The heart muscle is dark, brownish-red and slightly mottled by patches of a lighter color." The aorta was normal, the coronary arteries normal.

Microscopically, the heart showed diffuse, fine, fatty degeneration. Typhoid bacilli were cultivated from the spleen, liver and kidneys. Staphylococcus albus was obtained from the endocarditic vegetations.

Case IX (No. 28194). M. S., a man of 18, was admitted to the hospital on the fifth day of a very severe typhoid fever. On entry the heart sounds were loud and clear. Delirium soon developed and the pulse became rapid and feeble. On the following day a rather soft systolic murmur was heard at the apex, transmitted to the axilla. The second aortic sound was markedly accentuated. The patient's condition did not change essentially; the delirium and picking at the bed clothes continued. The leucocytes, which, on admission, had been 6000 to the cm., were on the 7th day, 17,000 and 28,000, and on the following day 18,600. On the evening of the 8th day the patient died. At the necropsy, which revealed characteristic typhoid lesions, the following note was made upon the heart. "Along the edges of the mitral valve there is a row of minute dew-drop-like excrescences which are less than pin-head in size. These are fairly firm, not easily scraped off. They can, however, be pulled off with forceps. Smaller similar excrescences are found on the aortic segments. Otherwise the valves are delicate and apparently competent. The heart muscle is rather soft, natural in color. The vegetations on the mitral valve are on the auricular side. To those on the aortic valve there is attached a soft clot." The aorta showed slight fatty degeneration of the intima.

Cultures showed both the bacillus typhosus and staphylococcus aureus from the heart's blood; staphylococcus aureus from the vegetations on the aortic valve.

Case X (No. 44240). The third case, C. M., a man of 25, was admitted to the hospital in the first week of a very severe typhoid fever. He had always been strong, athletic and vigorous. He had had measles in childhood and bronchial asthma off and on for eleven years. He was very ill and delirious from the onset. The heart's action was rapid, the sounds, however, always clear. Four days after entry the first sound was reduplicated at the apex, the second at the base. Eleven days after entry a phlegmon developed in the left submaxillary region. This was opened on the following day, cultures showing staphylococcus aureus. Twelve days after entry the patient suddenly died.

Necropsy showed numerous small translucent vegetations along the line of closure of the anterior segment of the mitral valve. The heart muscle was rather soft, opaque and grey, with numerous more opaque, distinct grey spots. The anterior descending branch of the coronary artery showed many yellow flakes of sclerosis varying from 1 to 2 mm. in diameter. Almost the whole intima was converted into irregular, yellow grey patches which were slightly elevated. The walls of the smaller branches were also thickened. The aorta showed only slight thickening just above the valves. In the wall of the left ventricle, near the auriculo-ventricular ring, there were a number of small patches in which the muscle was completely replaced by greyish-white, somewhat translucent fibrous tissue. Cultures from the vegetations showed staphylococcus aureus and albus.

It will be noted that the presence of endocarditis was unsuspected during life in all these cases. Indeed, there was nothing in the symptoms of the first or third cases which would have justified such a diagnosis. The development in the second case of the murmur, in association with a marked leucocytosis might have suggested the complication.

In three cases there developed during the disease, symptoms which persisted on discharge to an extent suggestive of an actual valvular lesion.

Case XI (No. 23799). The first case, a girl of 9, was admitted to the hospital on the 31st day of her disease. She had had no serious previous illnesses. The first sound on admission was nearly replaced by a soft blowing systolic murmur which was heard, though less intensely, as one passed toward the axilla; lost in the anterior axillary line. It was also audible over the base and præcordial region. The second pulmonic sound was somewhat accentuated. The apex was in the 4th left space, 6 cm. from the midsternal line. On the final note, over two months later, the point of maximum impulse was in the 4th space, 7 cm. from the median line, and the murmur, which was rough and rumbling, entirely covered and followed the first sound; it was, however, of greater intensity in the pulmonary area and was lost beyond the anterior axillary line. The leucocyte count varied between 6000 and 15,600.

It is of course possible that, in this case, the lesion may have preceded the typhoid fever, although there was no history of previous infections.

Case XII (No. 40588). The second case, M. S., a colored girl of 13, was admitted to the hospital on the tenth day of her disease. On entrance the heart sounds were clear at the apex and base. The leucocytes, which were 8800 on entry, varied during the next several days, between 6000 and 14,000. On the 19th day, without apparent cause, they were 18,600; on the 23rd day, 7500. No further note as to the condition of the heart was made until the time of discharge, the 66th day of the disease, the 14th of perfectly normal temperature. On this date there was heard, at the apex, a very faint systolic murmur, which was lost as the sternum was approached; it was, however, transmitted into the axilla as far as the mid-axillary line, and became intensified in the erect posture. The second pulmonic was accentuated. The pulse was 23 to the quarter, somewhat irregular in rhythm and volume, the irregularities mainly dependent on respiration.

The development and persistence in this case, of an apical systolic murmur in association with a rather unaccountable leucocytosis may be regarded as suspicious symptoms.

Case XIII (No. 44724). The third case was that of a man of 18 who had previously suffered from measles as a child and some severe illness, the nature of which he does not know, at four. He entered the hospital on the 9th day of a typhoid fever of moderate severity. On the 10th day the point of maximum cardiac impulse was in the 4th space 7 cm. from the mid-sternal line; the sounds were loud; the first, reduplicated at the apex and over the right ventricle. A well-marked systolic murmur was audible in the second and third interspaces in both aortic and pulmonic areas. It was not transmitted to the vessels of the neck, nor was any thrill to be felt in the aortic area. The patient passed through a mild attack of typhoid fever with a ten day's relapse. The temperature, between the 40th and 60th days, was slightly irregular, occasionally rising above 99°. The colorless corpuscles, during the early part of the malady, ranged from 3 to 4000. On the 69th day the leucocytes were 3800. On the 79th day, while the temperature was subnormal, it was noted that the point of maximum impulse was 10 cm. from the mid-sternal line, 3 cm. farther out than on entry. A definite systolic thrill was felt all over the cardiac area. At the second rib on the left sternal margin there was a distinct systolic murmur. The leucocytes were 7800 to the cu. mm. Two days later the point of maximum impulse was in the 5th left interspace, and a blowing systolic murmur was audible all over the cardiac area. This was well heard in the pulmonic region but over the aortic area it had become intensified and rougher.

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[22] Johns Hopkins Hospital Reports, 1895, V, 467.

On the following day, I found, at the base and especially in the aortic area, a very loud echoing systolic murmur. This reached its maximum in the first right space where it was harsh and rasping. It was well heard in the epi-sternal notch, slightly in the carotids. After exercising and lying down again a soft systolic murmur was heard at the apex. The pulse was distinctly long and well sustained, the tracings showing characteristic flattening of the summit of the curve.

This case, which was seen also a month after discharge, presents evident signs of aortic stenosis.

It is interesting to note that at the time when the character of the murmur at the base began to change, the leucocytes which had been almost invariably under 4000, went up to 7800. It seems reasonable to assume that in this instance an aortic endocarditis developed during the typhoid fever.

(5) Myocarditis.

There were few cases in which a definite diagnosis of acute myocarditis was made *intra vitam*. Indeed the symptoms upon which such a diagnosis may be based are still extremely questionable. Extreme rapidity and irregularity of the heart's action, embryocardia, the development of relative mitral insufficiency would lead one to suspect the existence of grave acute changes in the heart muscle. All these symptoms may, however, depend upon vaso-motor paralysis, indeed, the observations of Pässler and Rolly,[23] would tend to suggest that this is often the cause of the collapse at the height of many acute diseases, the true cardiac changes coming on in great part secondarily to and as a result of the impaired nutrition of the heart wall incident to the fall in blood pressure.

The heart muscle in many of the cases dying with symptoms of marked cardiac collapse showed the characteristic appearances described by the old observers—general flabbiness, a yellowish brown, dead leaf color, looseness, œdema and diminished consistency of the heart muscle and, not infrequently, a distinct mottling suggestive of fatty change. In how far the development of systolic apical murmurs at the height of typhoid fever may be regarded as indicative of true myocarditis is a point which we must regard at present as quite unsettled.

A comparison of the more minute histological changes in the heart wall with the clinical symptoms in our fatal cases is one of the important points of this investigation which I have not as yet been able to approach.

One case which must be regarded as an example of weakness of the heart muscle immediately subsequent to what was probably a mild typhoid fever may be of interest.

Case IV[24] (No. 41270). F. J., aged 40, was admitted to the hospital on the 4th day of a mild typhoid fever. He had had rheumatism 23 years previously, and chills and fever three weeks before entry. On entry the heart sounds were clear though the first was rather muffled. On the 11th day a well-marked systolic murmur was heard at the apex, almost completely replacing the first sound and propagated to the anterior axillary line. It was not heard in the tricuspid area, nor above the 4th rib. At the base, both sounds were clear. Three days later it was noted that the pulmonic second sound was accentuated, while a soft diastolic murmur was heard along the left sternal border in addition to the systolic murmur at the apex. On the 18th day the temperature was subnormal, the diastolic murmur had entirely disappeared and the systolic murmur was barely audible. On the day of discharge, the 34th, the heart sounds were clear excepting a slight reduplication of the second in the pulmonic area. The apex impulse was, however, 11 cm. from the median line, 2.5 cm. further out than on entrance.

The fact that these cardiac manifestations were associated neither with fever nor with leucocytosis speaks rather against the existence of a true endocarditis and in favor of a purely myocardial weakness.

(6) Venous Thrombosis and Phlebitis.

Among the 1458 cases of typhoid fever there were 38 instances of venous thrombosis, a percentage of over 2.6.

In addition to these cases two patients with this complication were admitted during convalescence, while one man who had suffered from double iliac thrombosis complicating typhoid fever entered the hospital two years later on account of the resulting symptoms.

Mortality.—5 or 13.1 per cent of these cases resulted fatally.

In two instances the thrombosis was probably the primary cause of death, once, through pulmonary embolism from a thrombus in the left axillary artery (No. 27855), once (No. 28,600), in a case of thrombosis of the left common iliac and femoral veins, through the lodging of a large embolus in the inferior cava and right auricle.

Situation of the Thrombus.

(a) As to section of the body.

In these 41 cases the thrombosis was:
In the lower extremities in 39 cases.
In the upper extremity in 1 case.
In the pulmonary artery in 1 case.

(b) As to side.

The occluded vessel was:
On the left side in 26 instances.
On the right side in 5 instances.
On both sides in 8 instances.
Imperfect record in 2 instances.

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[23] Experimentelle Untersuchungen über Kreislaufstörungen bei acuten Infectionskrankheiten. Deutsch. Arch. f. klin. Med., 1903, LXXVII, 1.

[24] Vide supra, p. 327.

(c) As to vessels.

The femoral vein was occluded in 20 instances.
The popliteal vein was occluded in 5 instances.
The iliac vein was occluded in 5 instances.
The veins of the calf were occluded in 5 instances.
The internal saphenous was occluded in 3 instances.
The pulmonary artery was occluded in 1 instance.
The pulmonary artery and common iliac vein were occluded in 1 instance.
The axillary vein was occluded in 1 instance.

In six of the cases of femoral thrombosis, plugging of the internal saphenous was also noted.

SYMPTOMS.

Time of onset.—The thrombosis occurred usually toward the latter part of the fever and in a number of instances after complete defervescence. The time of onset is illustrated in the following table:

TABLE III.

Illustrating the Time of Onset of 38 Cases of Venous Thrombosis.

WEEKS.

	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	?	Total
Cases	1	1	10	8	5	3	2	4	0	1	1	0	1	1	= 38

Fever.—In 35 of our 38 cases the development of the thrombosis was associated with fever; in 3 there was no fever.

In 25 cases the fever was intercurrent, the phlebitis coming on before complete defervescence.

In 13, the temperature was normal at the time of the onset of the phlebitis.

Chills.—In 11 or 28.9 per cent of these 37 cases the complication was associated with chills.

In 2 instances the chills occurred just at the time of recognition of the condition.

Twice the chills occurred before recognition, once four days and once a week before.

In 6 cases the chills occurred during the course of the complication, once during the period of subsidence and in the other five instances during the height of the process.

Once, the chills occurred before, during and after the apparent onset of the thrombosis.

In one of the three cases entering the hospital after the acute symptoms had passed, there was a history of chills, their exact relation, however, to the time of development of the thrombosis was not clear.

Pain.—The first definite symptom of the thrombosis in every instance was pain. This varied considerably in intensity and suddenness of onset.

(a) Character of the first symptoms in 18 cases of femoral thrombosis.

In all the cases of femoral thrombosis but one there was pain along the course of the femoral vein. In this one instance the only symptoms noted in the hospital were those of popliteal thrombosis. The subsequent history of the case, however, made it clear that there must also have been plugging of the femoral vein.

The first localizing symptom of the process was:

Pain along the course of the femoral vessels and in Scarpa's triangle in 9 instances.
Pain in the calf in 4 instances.
Pain in the popliteal region in 1 instance.
No satisfactory note in 3 instances.
Patient too ill to localize pain in 1 instance.

In 3 of these cases the onset of the pain was strikingly sudden.

(b) Character of the first symptoms in 5 cases of popliteal thrombosis.

In all of the cases of popliteal thrombosis the first symptom was pain in the popliteal region.

(c) Character of the first symptoms in 5 cases of iliac thrombosis.

In the cases of iliac thrombosis the onset was associated with sudden sharp abdominal pain in 4 cases. In one of these instances the pain was extremely severe and associated with marked leucocytosis, the symptoms suggesting perforation. An exploratory laparotomy was performed, revealing the true nature of the lesion. In one instance in which the patient was hemiplegic and dull, there was no pain.

(d) Character of the first symptoms in 5 cases of thrombosis of deep veins of the calf.

In all of these cases the first symptom was pain in the calf.

(e) Character of the first symptoms in 3 cases of thrombosis of the internal saphenous vein.

In 3 cases in which there was thrombosis of the internal saphenous vein alone the first symptom was pain along the course of the vein in every instance.

(f) In the one case of axillary thrombosis the first complaint was of pain about the bend of the elbow.

Œdema.—In all of the 38 cases there was swelling of the affected part and in most instances the local temperature was raised. Often there was redness over the affected vessel. A definite note as to the existence of œdema was unfortunately not made in all cases.

(a) In 18 cases of femoral thrombosis:

Œdema was noted in 10 cases.
"Swelling" alone, in 6 cases.
There was no œdema in 2 cases.

(b) In 5 cases of iliac thrombosis there was:

Œdema in 2 cases.
No œdema in 3 cases.

(c) In 5 cases of popliteal thrombosis there was:

Œdema in 2 cases.
"Swelling" in 1 case.
No note in 1 case.
No œdema in 1 case.

(d) In 5 cases in which the veins of the calf were apparently involved alone there was:

Œdema in 1 case.
"Swelling" in 3 cases.
No œdema in 1 case.

(e) In all 3 cases in which the internal saphenous vein and calf muscles were involved there was œdema.

(f) In the case of thrombosis of the axillary artery there was œdema.

Palpability of the thrombotic mass.—In 16 out of 38 cases the thrombotic mass was felt as a palpable cord.

Leucocytosis.—In 21 cases counts of the colorless corpuscles were made during the complication.

In 12 or 57.1 per cent the leucocytes were above 10,000.

In 18 or 85.7 per cent they were above 7000.

In one instance they were below 6000.

The highest count, 24,864, occurred in a case of iliac thrombosis in the third week of the disease. In this instance an exploratory laparotomy was done in view of the possible existence of perforative peritonitis. The lowest count, 2700, occurred on the day after the onset of a phlebitis, apparently of the popliteal, which occurred in the sixth week without fever and with very slight general symptoms.

In connection with these blood counts it should be remembered that, in every instance but one the phlebitis came on in the third week of the disease or later, at a period when, according to our statistics, the leucocyte count in uncomplicated cases should not be above 5500.

Association with secondary infections.—Out of our 38 cases there were 7 instances in which secondary infections preceded or co-existed with the onset of the thrombosis. These secondary processes were:

Boils in 2 cases.
Well-marked bronchitis in 1 case.
Gangrene of the lung in 1 case.
Fistula in ano in 1 case.
Chronic otitis media in 1 case.
Amœbic dysentery with developing hepatic abscess in 1 case.

In the remaining 31 instances there was no clinical evidence of secondary infection.

Post-mortem appearances.—In the 3 cases in which bits of the clogged vein were examined histologically, evidence of well marked inflammatory changes were found in the walls of the vessels, such, however, as might well have arisen secondarily to the thrombosis. In one of these cases there was at the point of section, an extensive endophlebitic plaque which however, probably antedated the typhoid fever. But few sections were examined and it is improbable that these came from the point of origin of the thrombi, so that conclusions with regard to the pre-existence of a phlebitis are not justified.

Cultures.—In one case the bacillus typhosus was obtained in pure culture from the thrombus.

In 1 the cultures were negative.

No notes were made with regard to cultures from the thrombus in the other 2 cases.

A consideration of the character and extent of the general symptoms in this group of cases would seem to justify the conclusion that in most instances the thrombosis was associated with and preceded by a phlebitis.

Especially interesting is the frequency of chills in association with the complication. Unaccountable chills at the height or toward the latter part of typhoid fever, should always give rise to the suspicion that a phlebitis may be developing.

(7) ARTERIAL THROMBOSIS AND ARTERITIS.

Five cases of arterial thrombosis or arteritis developed under our observation.

CASE XIV[25] (No. 12616). The first case was that of a young man of 22, of excellent family and personal history, who was admitted to the hospital on the 24th of April, 1895, on the 4th day of a mild typhoid fever. On the 9th day he was seized suddenly with violent general convulsions, the movements being rather more marked on the right side. There was conjugate deviation of the eyes upward and to the left. The convulsions recurred at short intervals for about an hour. During the paroxysms, the patient was profoundly unconscious, though between times his mind seemed partially clear. After an intermission of about four hours the convulsions returned, recurring with great severity at intervals for six hours, when death occurred during a severe paroxysm.

The necropsy performed by Dr. Flexner, showed a thrombosis associated with an acute arteritis of the ascending parietal and parieto-temporal branches of the left middle cerebral artery. The extent of the arteritis, together with the fact that it was found in branches in which there was as yet, no thrombosis, led us to regard it as having preceded the occlusion of the vessel.

CASE XV[26] (No. 28600). The second case was that of a man of 46 who entered the Johns Hopkins Hospital on the 27th of November, 1899, on the second day of typhoid fever. He had had measles and mumps as a child and a year before a slight arteritis of the left ankle. He had had a venereal ulcer of doubtful character, without secondary symptoms, seven or eight years before. On the 19th day of his disease, while delirious, he gradually developed a complete hemiplegia of the left side. The respiration became of a Cheyne-Stokes character, which persisted during the next several days. There was no loss of consciousness. Five days later he died suddenly from embolism of the inferior cava, resulting from the breaking off of a large thrombus in the left iliac vein. The necropsy showed an area of softening in the upper part of the right internal capsule, due undoubtedly to the plugging of the branch of the artery supplying the area. The leucocytes, which on entry, were 6200, were 9250 to the cu. mm. during the onset of the symptoms of occlusion.

CASE XVI[27] (No. 39264). The third case was that of a girl of 16 who entered the hospital on the 16th of June, 1902, on the 5th day of a severe typhoid fever. There was a marked general bronchitis, and on the 8th day of her illness, evidences of bronchopneumonia appeared. The leucocytes at this time were, on two counts, 6000 and 5000 to the cu. mm. On the 11th day there was a slight leucocytosis. On the succeeding three days the patient seemed better until, on the 14th day, on removing her from the tub, the right foot and leg below the knee were found to be white and cooler than on the left side. The coolness extended above the knee in front. There was no swelling of the leg or foot. The femoral artery could be followed by its pulsation half way down the thigh. No pulse was palpable in the popliteal or dorsalis pedis. The patient was delirious and in a condition of profound intoxication; the leucocytes were 17,000 to the cu. mm. Gradually, a line of demarkation developed about at the junction of the upper and middle thirds of the leg with dry gangrene below. The condition of the patient became gradually worse and death followed on the 22nd day. The heart's action was rapid throughout the disease, but there was no evidence of dilatation, the sounds were always clear, and there were no signs of embolism elsewhere. The case was regarded by Dr. McCrae and the writer as one of thrombosis rather than embolism. No necropsy was allowed.

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[25] Reported by Dr. Osler, Johns Hopkins Hosp. Reports, 1900, VIII, 364; and by Thayer, N. Y. State Journal of Medicine, 1903, III, 21-28.

[26] Reported by Dr. Osler. Johns Hopkins Hosp. Reports, 1900, VIII, 368.

[27] Reported by Thayer. N. Y. State Journal of Medicine, 1903, III, 21-28.

Case XVII[28] (No. 39471). The fourth case was that of a boy of 18 who, on the 14th day of a fairly severe typhoid fever, began to complain of pain and tenderness on the inner side of the thigh along the course of the femoral vessels, extending subsequently to Scarpa's triangle. The left thigh was warmer than the right and swollen, while the foot and leg were pale and cool. There was no œdema. The pulse in the femoral and arteries of the foot almost disappeared. The symptoms soon began to improve, but on the 49th day, pain and swelling appeared in the popliteal space and calf, the foot became cooler and cyanotic again, and the arterial pulse in the foot once more entirely disappeared. There was slight œdema about the malleoli. The œdema lasted but a few days; the pulsations in the arteries gradually improved, and the patient was discharged apparently well on the 71st day.

Case XVIII[29] (No. 40343). The fifth case was that of a woman of 27, who on the 21st day of a mild typhoid fever, began to complain of pain at the bend of the elbow where there was marked tenderness with slight redness and swelling. The radial pulse was diminished in size and the hand cooler and paler than the right. In the course of several days, however, the symptoms wholly cleared up.

In these two latter cases it is a question whether an actual thrombosis developed or whether the symptoms may not be regarded as due to an acute arteritis alone, the interference with the circulation following the œdema and infiltration of the walls.

In addition to these cases there have been treated in the hospital 3 instances of hemiplegia in which the onset occurred during typhoid fever, while Dr. Thomas has kindly given me the notes of two further cases which he has observed in the out-patient department.

Case XIX[30] (No. 14083). The first case was that of a girl of 7, who entered the hospital on October 3, 1895, complaining of inability to use the right hand. On June 3, during the 9th week of a rather severe attack of typhoid fever, the child was seized with violent convulsions confined to the head, right arm and leg. On the afternoon of the day of onset the movements of the head, which the mother described as having been thrown backward, ceased. Continued movements of flexion and extension of the limbs followed for two days. When these came to an end, it was noticed that the right arm and leg were paralyzed. There was also involvement of the face and total loss of speech. Five weeks after onset spastic rigidity of the arm was noticed. Six weeks after the onset movements of the leg began to return. In the seventh week there was some return of speech. At the time the patient was in the hospital, the speech was improving rapidly, though it was still very imperfect. The child recognized objects and looked bright and intelligent. The right leg was dragged, the foot inverted. The right arm was held semiflexed, the wrist and hand flexed with marked spastic rigidity. She could voluntarily flex and extend the arm at the elbow and could lift the hand to the head, but the power of extension in the wrist and of the fingers and the ability to grasp objects with the hand were almost completely lost.

Case XX[31] (No. 14630). The second case was that of a man of 25, of excellent family history, who entered the hospital on November 30, 1895. In March, at the end of the second week of a severe attack of typhoid fever, a paralysis of the left arm and leg suddenly developed. There were no convulsions, and his physician states that there was no aggravation of the delirium during the attack. There was no difficulty in speaking and no trouble with the rectum or bladder. When in the hospital there was no trace of paralysis of the facial muscles; the left arm could be moved at the shoulder and elbow and slightly at the wrist in flexion. The hand could be extended but only slight movements of extension of the fingers were possible. The power of pronation and supination was lost. The left leg could be moved freely at the thigh and flexed and extended at the knee. The reflexes on the left were everywhere increased. Wide, irregular, choreiform movements were noted when the patient attempted to move the left arm.

Case XXI (No. 30540). The third case was that of a man of 34, who was admitted to the hospital on the 19th of May, 1900. In the fall of 1897 he had had a severe typhoid fever during the third week of which he became delirious. On recovering consciousness, in the 9th or 10th week, he found that his left arm and leg were paralyzed. Three years later, at the time he was in the hospital, he showed distinct loss of power, with spastic contractions in both extremities and athetoid movements of the hands.

Case XXII (Nervous Dispensary No. 13149). The fourth case was that of a girl of 8, who entered the Nervous Department of the Dispensary on the 13th of March, 1902, complaining of weakness on the right side. There was nothing remarkable in her family or previous history. Four and a half years before, in October, during the third or fourth week of a typhoid fever, she developed a right-sided hemiplegia. There were no violent convulsions though it is stated that "she straightened out." She was unable to clearly understand what was said to her. There was loss of control of the bladder and rectum, and involvement of the facial muscles. The power of speech began to return about eight months after the onset; she was unable to walk for a year. The facial paralysis disappeared after several months and the control of the bladder and rectum after about six months. At the time when she reported at the dispensary, the right arm was wasted and shorter than the left. There was wrist drop, and the fingers were flexed; there was spastic contraction of the flexors at the elbow and stiffness on trying to extend the wrist. There was slight toe drop on the right side, though the patient walked fairly well, the right foot being dragged but little.

Case XXIII (Nervous Dispensary No. 15179). The fifth case was that of a girl of 10, of good family and previous history excepting for the fact that at 2 she had had chills and fever and convulsions. At the age of 4 she had typhoid fever. After about three weeks she was so much better that she sat up in bed. This was followed by a relapse in which there developed a right-sided hemiplegia. While sleeping, she suddenly waked with a scream and fell back unconscious. There were no convulsions. She did not recognize any one for 21 days, and did not walk for a year. Speech began to return after about three months. At the time when she consulted Dr. Thomas, six years after her illness, there were contractures and athetoid movements in both arm and leg.

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[28] Reported by Thayer. N. Y. State Journal of Medicine, 1903, III, 21-28.

[29] Reported by Thayer. N. Y. State Journal of Medicine, 1903, III, 21-28.

[30] Reported by Blumer. Johns Hopkins Hospital Bulletin, 1896, VII, 72.

[31] Reported by Dr. Osler. Johns Hopkins Hospital Reports, 1900, VIII, 367.

In this connection I may mention a very remarkable instance which was communicated to me a year ago by Dr. Royster of Norfolk.

Case XXIV. A girl of 8, in the 4th week of a typhoid fever of moderate severity, when the temperature had nearly reached a normal point, developed a left-sided hemiplegia involving the face, arm and leg, in association with paralysis of the right third nerve—a typical Weber's syndrome. The onset was associated with convulsions. A year later the child still had at times spasmodic twitchings involving the left side and the right eye and occasional general convulsions. The lesion in this case was undoubtedly peduncular, probably thrombotic.

Two cases of cerebral thrombosis with aphasia and hemiplegia which I have previously reported,[32] may be also included in this list. Both of these instances were observed in the Massachusetts General Hospital.

Case XXV. The first of these cases was that of a man of 21, of good family and previous history, who on the 10th day of a fairly severe typhoid fever, developed a complete right-sided hemiplegia with aphasia. There were no convulsions; the patient was dull but not unconscious at the time of onset. About three months later he was able to walk and the power of speech was returning. There was still, however, but little return of power in the forearm and hand.

Case XXVI. The second instance was that of a girl of 10, who, in the 4th week of typhoid fever, developed paralysis of the right arm with aphasia. At the time of onset the child was in a dull stupid condition but there were no convulsions and no loss of consciousness. Six weeks later, the movements of the hand and arm were almost as good as on the other side, but the child seemed mentally dull.

I have also the notes of an extremely interesting case, the anatomical specimens from which were sent to me by my friend Dr. Akerman of Wilmington, North Carolina.

Case XXVII. The patient, a man of 31, of good habits, with no history of previous serious illnesses, entered the James Walker Memorial Hospital on July 1, 1903, on the third or fourth day of a severe typhoid fever. At the end of the second week (13th or 14th day) there developed a complete left-sided hemiplegia. The patient was delirious at the time of onset of the paralysis but not unconscious. Two weeks later, despite the gravity of the condition, signs of return of power on the paralyzed side began to appear. In the beginning of the 5th week (July 25) there developed a right femoral phlebitis. The patient, who was very ill throughout, gradually failed and died on the 41st day. The autopsy showed extensive infarctions of the spleen and kidneys, due apparently to autochthonous thrombosis. The heart showed nothing remarkable; the brain, which was preserved whole, was unfortunately lost on account of a mistake in the preserving fluid, so that the exact location of the lesion could not be determined. There can, however, be little doubt from the character of the case that it was an instance of thrombosis.

Time of Onset of Symptoms.

Considering these 14 cases together the onset of the symptoms occurred:

In the second week in 4 cases.
In the third week in 4 cases.
In the fourth week in 3 cases.
In the third or fourth week in 1 case.
In the sixth week in 1 case.
In the tenth week in 1 case.

Of the 8 cases in which the onset was observed, in all but one it occurred during the febrile period.

The complication appeared to have slight influence on the course of the *fever,* excepting in the first case where the temperature rose up to the time of death.

In none of the cases were there *chills.*

Leucocytosis.—In the four cases in which blood counts were made the leucocytes were: 17,000
13,200
9,500
9,250

Taking into consideration the clinical symptoms in connection with the temperature records and the microscopical observations in the first case, it would seem not improbable that in all of these cases there was a primary arteritis. Whether in cases XVIII and XIX a partial parietal thrombosis occurred or whether the symptoms are to be ascribed to the interference with the circulation incident to the swelling of the arterial walls alone must remain an open question.

A striking point of variance between these cases and those of phlebitis is the difference in their distribution. Of the fourteen instances of arterial thrombosis but 2 occurred in the lower extremities. One developed in the arm and the remaining in the cerebral vessels.

Again, among these 14 cases the distribution as to the side of the body was more nearly equal, 6 being right-sided and 8 left-sided lesions. These particular figures cannot of course be compared with the cases of phlebitis which were in such preponderance, limited to the lower extremities. The statistics of Keen,[33] however, show that arterial thromboses are much more evenly distributed between the two sides.

Acute Aortitis.—We have never observed during life symptoms similar to those described by Potain,[34] as suggestive of the existence of acute aortitis, nor have our necropsy records shown changes which could well produce such symptoms.

III. Analysis of the Necropsy Records.

Between the fifteenth of May, 1899, and the first of January, 1903, there were 132 fatal cases of typhoid fever with 95 necropsies.

Heart Muscle.—Upon the gross appearances of the heart muscles comment has already been made. A study of the microscopical changes with modern methods of investigation, in those cases from which tissues have been saved, and a comparison of the results with the clinical histories is an important part of this investigation which I have as yet been unable to carry out. From what observations I have made I am convinced that there is room for further study of the changes occurring in the heart muscle in typhoid fever.

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[32] Johns Hopkins Hosp. Bull., 1896, VII, 73.

[33] Surgical Complications and Sequels of Typhoid Fever. Philadelphia, 8°, 1898, 76-78.

[34] De l'aortite typhique. Semaine méd., Par., 1894, XIV, 460.

It is unnecessary here to refer to the fatal cases of acute endocarditis, pericarditis, phlebitis and arteritis, mention of which has already been made.

The Arteries.—Of especial interest, it seems to me, is the question as to the relation of acute infections in general and typhoid fever in particular to acute and chronic changes in the aorta and general arterial system. The occasional existence of acute arteritis in the larger peripheral vessels has already been mentioned in connection with arterial thrombosis. There is a feeling among many observers that the severe acute infections play a more or less important part in the causation of focal endarteritic changes in the aorta and other vessels which may subsequently give rise to grave functional disturbances, yet a really systematic research into the effects of typhoid fever upon the heart and arteries has not, so far as I know, been made.

A mere survey of the protocols of our necropsies reveals some interesting points. In a large proportion of these cases, unfortunately, little attention has been paid to the vessels, and where observations have been made, these are restricted almost entirely to the aorta and coronary arteries. In a considerable number of cases, however, especially in recent years, since our attention has been more particularly directed toward this point, relatively fresh sclerotic changes have been described in the intima of the aorta and coronary arteries.

The Aorta.—Out of 52 cases in which notes upon the condition of the aorta were made, there were evidences of sclerosis in 30. These changes were apparently recent in at least 21 instances.

The Coronary Arteries.—Especially interesting are the records with regard to the coronary vessels. Out of 62 cases in which the condition of the coronary arteries was recorded, there were 19 in which definite sclerotic changes were noted. In four other cases yellow opacities in the intima were described. In 13 of these cases the changes were early and apparently recent. These observations are, it seems to me, of considerable significance. They are markedly at variance with the above quoted experience of Curschmann.

One case, of recent occurrence, is particularly suggestive.

Case XXVIII (No. 40831). A strong, vigorous man of 25, of excellent history and habits, who had suffered from measles at 21, mumps at 23 and chicken pox at 24, died at the end of the third week of a very severe typhoid fever. The heart's action was rapid but there was no apparent dilatation and no cardiac murmurs. The pulse tension was remarkably low. At necropsy several very early patches of endarteritis were found at the root of the aorta, and one or two on the ventricular surface of the mitral valve; these were slightly raised areas, in part somewhat yellowish, in part still translucent. On opening the coronaries there were found "numerous patches of yellowish sclerosis, especially in the anterior descending branch. The posterior branch also shows extensive sclerosis. The patches are small and discrete and in large part translucent, spotted with yellow." Sections through these areas show a very early process, so much so that one may well ask whether the lesions did not originate in the course of the typhoid infection.

This patient was one of the house physicians, with regard to whose habits and life we had peculiarly good information. He was a man of exemplary habits who had not been given to excesses of any sort; he had never been in the habit of taking over-violent physical exercise, and as has been said, had suffered only from measles, mumps and chicken-pox. The lesions present in the coronary vessels were really extensive, and in the course of the regressive changes which must have followed had he recovered, might well have given rise to sufficient stenosis to result in the gravest damage to the cardiac muscle.

Such a case can but impress one with the importance of more careful observations upon this point. As Brault[35] said some years ago, "Alterations in the arteries of patients dead of typhoid fever should be carefully looked for, as well in the arteries of the extremities as in the aorta and arteries of the base of the brain. It is the only way to settle the question as to whether arterial affections are frequent in this disease."

IV. A Study of the Subsequent Condition of 189 Patients who Passed through Their Typhoid Fever in the Wards of the Johns Hopkins Hospital within the Past Fourteen Years.

A point of fundamental importance with regard to the question of the effect of typhoid fever on the heart and vessels, would be the study of the subsequent condition of the vascular apparatus of a sufficient number of patients at a later period. The only method of solving this question would seem to be the careful observation of a large number of individuals during months and years following their typhoid fever. This is naturally a difficult thing to do, and the results of such an investigation must very naturally be affected by a variety of disturbing influences. Nevertheless it seemed to me that it might not be uninteresting to examine the hearts and arteries of as many of our old typhoid patients as could be reached, and especially, to observe the subsequent course pursued by those cases in which cardiac and vascular lesions were recognized at the time of their disease. Within the last two years I have examined 189 of our old typhoid patients. The results of these investigations, which have, in great part, been reported in the March number of the American Journal of the Medical Sciences[36] I will give here in brief:

(1) Age and Date of Attack.

The ages of the patients varied between 3 and 69 years, while the periods which had elapsed between the discharge from the hospital and the subsequent examination ranged from one month to thirteen years.

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[35] Les artérites. Leur rôle en pathologie. Paris (not dated). Masson & Gauthier-Villars (Encyclopédie scientifique des aide-mémoire).

[36] On the Late Effects of Typhoid Fever on the Heart and Vessels. Amer. Journ. Med. Sc., 1904, CXXVII, 391.

The following table will show the period of time which had elapsed between the discharge of the patient from the hospital and the subsequent examination.

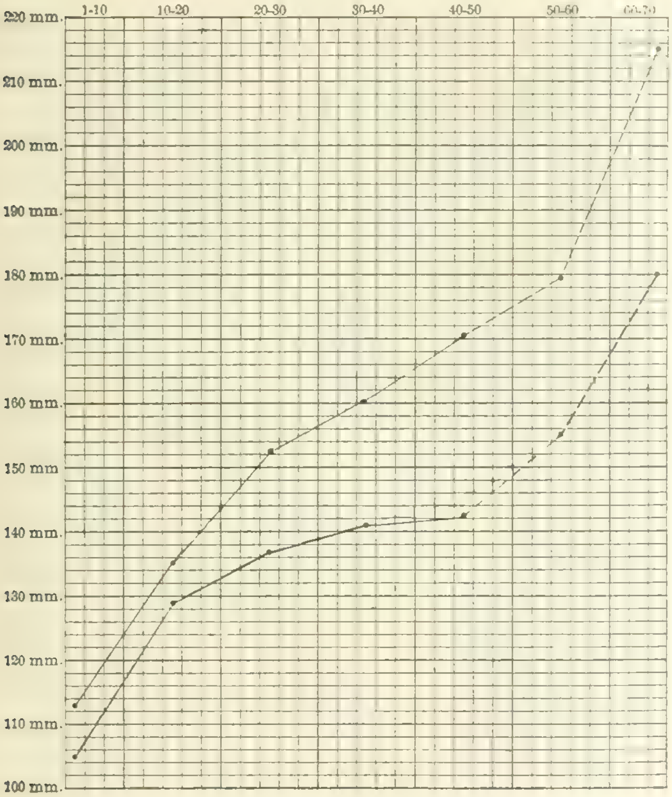
Table IV.

Showing the Length of Time which had Elapsed Between the Discharge of the Patient from the Hospital and his Subsequent Examination.

	MONTHS.		YEARS.													
	1–6[37]	6–12.	1	2	3	4	5	6	7	8	9	10	11	12	13	
Cases	22	26.	19	21	23	22	11	13	11	10	6	2	1	1	1	= 189.

(2) *Pulse.*—With regard to the rate and regularity of the pulse, nothing especially remarkable was noted.

CHART I.



(3) Systolic Blood Pressure.

Of especial interest, however, were the observations upon the systolic blood pressure. These were made by means of the Riva Rocci apparatus. The patients were always in the recumbent posture, the estimate being made as the last step in the examination in order that psychical influences might be excluded as far as possible. The results of these estimations compared with a series of similar observations on healthy individuals who had never had typhoid fever are indicated in the following table which is graphically represented on Chart No. 1.

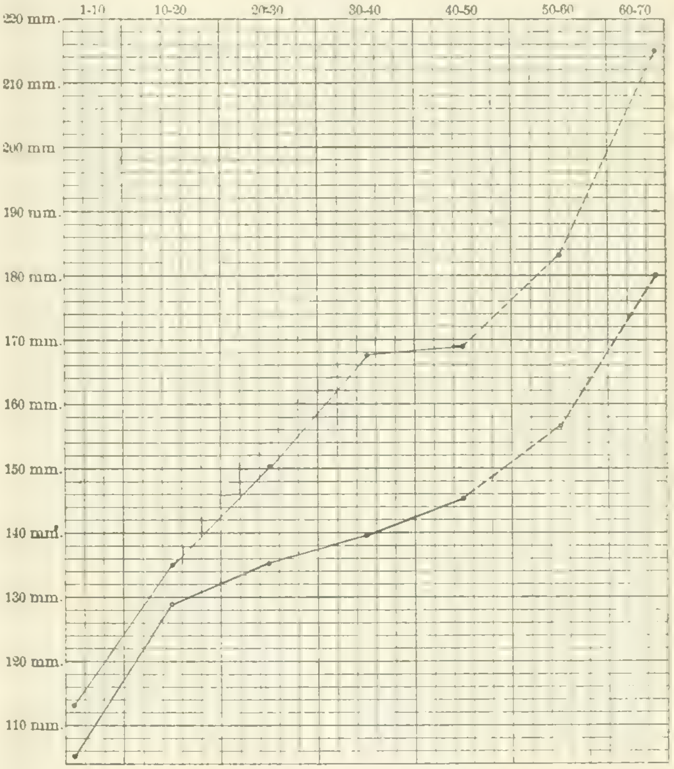
Table V.

Showing the Averages of the Systolic Blood Pressure in 276 Healthy Individuals and 172 Old Typhoids, Arranged According to Age by Decades.

1-10	10-20	20-30	30-40	40-50	50-60	60-70
OLD TYPHOIDS.						
112.4 mm.	135.2 mm.	152.5 mm.	160.8 mm.	170.2 mm.	179.6 mm.	215 mm.
(5 cases).	(39 cases).	(61 cases).	(48 cases).	(15 cases).	(3 cases).	(1 case).
HEALTHY INDIVIDUALS.						
104.6 mm.	128.7 mm.	136.9 mm.	140.8 mm.	142.2 mm.	154.8 mm.	180 mm.
(37 cases).	(87 cases).	(89 cases).	(37 cases).	(20 cases).	(5 cases).	(1 case).

This table reveals the interesting fact that the average blood pressure in the old typhoids was uniformly higher than that in healthy individuals who had never had the disease. A further analysis of our records shows that a large proportion of the old typhoids showed blood pressures above what are usually regarded as the normal limits.

CHART II.



In order to eliminate some of the numerous sources of error I prepared other tables excluding from each list all those cases in which a history of scarlet fever, diphtheria, acute rheumatism, pneumonia, erysipelas, small-pox or alcoholic habits could be obtained.

Table VI.

Showing the Averages of the Blood Pressure in Old Typhoids and Normal Individuals, from which all Cases with a History of Serious Infectious Disease or Alcoholic Habits have been Excluded.

1-10	10-20	20-30	30-40	40.50	50-60	60-70
OLD TYPHOIDS.						
113.2 mm.	134.9 mm.	150.3 mm.	167.6 mm.	168.7 mm.	183.5 mm.	215 mm.
(4 cases).	(28 cases).	(34 cases).	(27 cases).	(8 cases).	(2 cases).	(1 case).

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[37] There were but three cases seen under three months from the time of discharge.

HEALTHY INDIVIDUALS.

105.5 mm.	128.3 mm.	135.1 mm.	139.8 mm.	145.2 mm.	156.4 mm.	180 mm.
(32 cases).	(62 cases).	(52 cases).	(10 cases).	(11 cases).	(4 cases).	(1 case).

These tables illustrated by Chart II, show, as may be immediately observed, no essential variation from the previous curve. The alteration of the typhoid curve, due to the higher figures in the column for the thirtieth and fortieth decades, only emphasizes the fact that the number of cases was still too small to allow of the construction of final charts.

(4) PALPABILITY OF THE RADIAL ARTERIES.

Another striking feature in the examination of our old typhoids was the remarkable frequency with which the radial arteries were palpable. The following table which is illustrated by Chart III, shows a comparison of the figures in our old typhoids arranged according to decades, and a series of 421 healthy individuals who had never had typhoid fever. From our figures it appears that between the ages of ten and fifty years 48.3 per cent of the old typhoids showed palpable vessels, as compared with 17.5 per cent of the control cases.

CHART III.

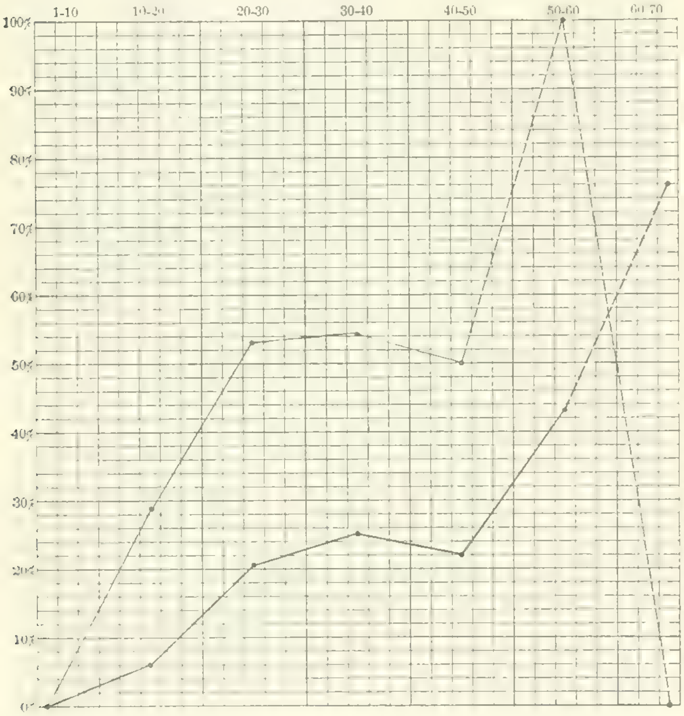


TABLE VII.

Showing the Percentages of Palpability of the Radial Arteries in 188 Old Typhoids and in 421 Healthy Individuals who had Never had Typhoid Fever, Arranged According to Age by

OLD TYPHOIDS.

1-10	10-20	20-30	30-40	40-50	50-60	60-70
0%	28.5%	53.1%	54.2%	50%	100%	0%
(5 cases).	(42 cases).	(64 cases).	(59 cases).	(14 cases).	(3 cases).	(1 case).

HEALTHY INDIVIDUALS.

0%	6.1%	20.4%	25%	22%	42.8%	80%
(37 cases).	(98 cases).	(186 cases).	(61 cases).	(27 cases).	(7 cases).	(5 cases).

As in the case of the blood pressure I have also prepared a second table including those cases only, in which a history of alcoholic habits and the more serious acute infections were absent. These figures, illustrated by Chart IV, show little variation from those based upon a larger number of cases.

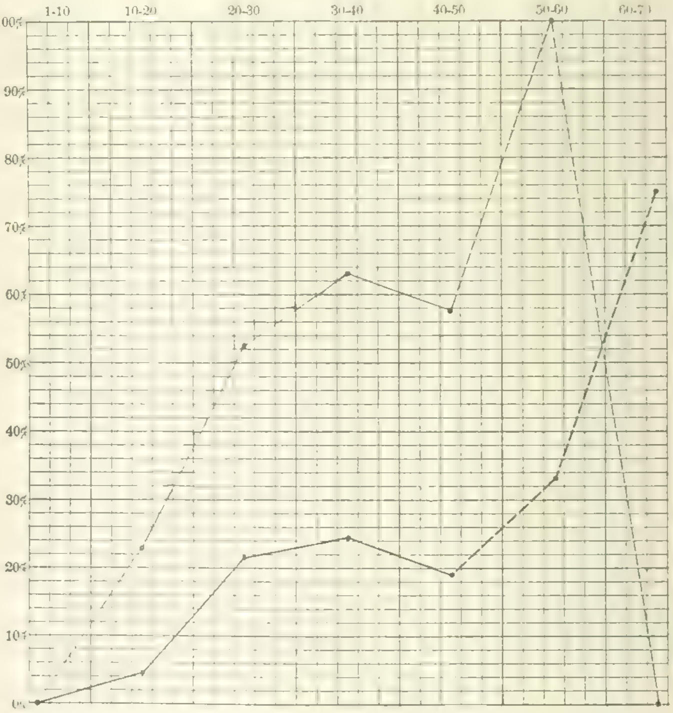
TABLE VIII.

Showing the Percentages of Palpability of the Radial Arteries in Old Typhoids and in Healthy Individuals from which All Cases giving a History of Serious Infections or Alcoholism have been Excluded.

OLD TYPHOIDS.

1-10	10-20	20-30	30-40	40-50	50-60	60-70
0%	22.5%	52.6%	63.3%	57.1%	100%	0%
(4 cases).	(31 cases).	(37 cases).	(30 cases).	(7 cases).	(2 cases).	(1 case).

CHART IV.



HEALTHY INDIVIDUALS.

0%	4.2%	21.3%	22.2%	18.7%	33.3%	75%
(32 cases)	(70 cases).	(103 cases).	(27 cases).	(16 cases).	(6 cases).	(4 cases).

Results so striking and constant as these could hardly be accidental, and interesting confirmation is afforded by the following observations.

In connection with some studies on albuminuria which are being made by Dr. Emerson, abstracts were made of 2000 consecutive histories in the Medical Department of the Johns Hopkins Hospital. Out of these 2000 histories a definite note as to the palpability or non-palpability of the peripheral vessels was made in 1174 cases.

In 943 cases in which the radial arteries were palpable 188 or 19.9 per cent gave a history of typhoid fever.

Out of 231 cases in which the peripheral vessels were not palpable but 25 or 10.8 per cent had had the disease.

The frequency of a history of typhoid fever in the two groups arranged by decade is illustrated by the following table.

Table IX.

Showing the Relative Frequency of a History of Typhoid Fever in 1174 Consecutive Cases Arranged According to Age by Decades.

Cases in which the peripheral vessels were palpable:

1-10	10-20	20-30	30-40	40-50	50-60	60-70	70:80	80-90
0%	6.35%	17.28%	17.94%	24.74%	22.35%	24.36%	29.17%	0%
(2 cases).	(63 cases).	(191 cases).	(223 cases).	(190 cases).	(170 cases).	(78 cases).	(24 cases).	(2 cases).

Cases in which the vessel wall was not palpable:

1-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
0%	11.76%	10.45%	8.77%	17.39%	14.28%	14.28%	0%
(11 cases).	(51 cases).	(67 cases).	(57 cases).	(23 cases).	(14 cases).	(7 cases).	(1 case).

These figures can but be regarded as strongly supporting the indications resulting from our previous observations.

(5) Condition of the Heart in 188 Old Typhoids.

A consideration of the condition of the heart in our old cases both in the hospital and subsequently, reveals the interesting fact that the average size of the heart was greater among the old typhoids than in the same cases at the time of admission to the hospital, the difference holding good also when the cases were classed according to age by decade.

In 12 of these cases, where, on discharge from the hospital, the heart was considered normal, subsequent examination revealed evidences of organic disease; in eight instances, hypertrophy with mitral insufficiency; in one, possible mitral stenosis; in one, aortic insufficiency; in one, marked general arterio-sclerosis with hyper-tension.[38]

An interesting case of hypertrophy with mitral insufficiency consecutive to typhoid fever has recently come under my observation.

Case XXIX. H. C. M., aged 33, a patient of Dr. Frank M. Sharpe, of Brooklyn, N. Y., consulted me on the second of March 1904. He had had measles as a child and pneumonia at the age of 4 or 5, but no other serious illnesses. His habits were excellent. He had always been a strong, athletic man. Two years ago last January, he had an attack of typhoid fever, during which he was in bed three or four weeks. Ever since this illness, he has been rather nervous, so much so that he felt obliged to give up his indoor work. He has noticed also that he is losing the "strength and the go" that he used to have, and he has been conscious of shortness of breath on going up hills. A month and a half ago he had a mild attack of influenza. About a month ago, on being examined for life insurance, he was told that he had cardiac trouble. The doctor also advised him to give up base ball and other out-of-door sports.

On examination, the pulse was slow, the artery of rather large size; duration moderate; slight dicrotism. Maximum pressure (Riva Rocci), 185. The radials were palpable on both sides; temporals not prominent. The point of maximum cardiac impulse was localized in the 4th space, 9.2 cm. from the median line, the dulness extending 4½ cm. to the right; the greatest diagonal dulness, right to left, was 15 cm. In the erect posture, the impulse, which was strong, was in the 5th space, 9½ cm. from the median line—after a little exercise, 10 cm. The first sound was prolonged and followed by a very slight systolic murmur which was lost two fingers' breadths outside the point of maximum impulse; it was not heard in the tricuspid area, but was just audible in both areas at the base. In the erect posture, however, the murmur increased in intensity and was faintly heard in the axilla and back, as well as all over the cardiac area. The second sound was louder in the aortic than in the pulmonic area. After exercise (dancing on one foot), the pulse was raised to a little over 100, but soon fell.

A study of the subsequent condition of those cases showing a remarkably rapid or irregular pulse during the disease revealed little of interest excepting for the fact that the blood pressure was somewhat above the common average for the old typhoids.

Subsequent History of 31 Cases of Typhoid Fever in which a Systolic Murmur at the Apex was Audible During the Attack.

The patients who, during their attack, developed a systolic murmur at the apex of the heart, showed a higher average blood pressure than the general mean of the old typhoids. In 28 of these cases, where the systolic pressure was taken on later examination, the mean was 158.5 mm. against a general average for the old typhoids of 152.4. This higher average was observed in every decade excepting the first in which there was but one case, and in the third, in which there were but four. In 18 cases over 20 years of age, the average pressure was 169.2 as compared with a general average of 159.6 for the same decades. In 5 cases the pressure was above 200 mm.

The average size of the heart was found to be greater than in the same cases at the time of admission to the hospital or in the old typhoids as a whole.

In 11 of these instances the heart sounds were clear on the later examination. In 20, murmurs were heard.

In one instance the murmur was a slight cardio-respiratory systolic sound audible at the apex only.

In 6 cases there was a soft systolic murmur at the base, in some instances heard also over the right ventricle.

In 13 cases there was a systolic murmur at the apex of the heart. In 5 of these cases the signs justified the diagnosis of mitral insufficiency.

In one case there were signs suggestive of mitral stenosis.

In one case there was a marked arterio-sclerosis with hypertension.

One case was an instance of Graves' disease with a systolic murmur all over the cardiac area. This condition was also present at the time of the fever.

From this, the striking fact appears that over one-fifth of those cases in whom during typhoid fever, an apical systolic murmur was audible, showed on later examination evidence suggestive of organic cardiac lesion.

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[38] The full records of these cases may be found in Amer. Journ. Med. Sc., 1904, CXXVII, 410-420.

(6) Subsequent History of 16 Cases of Phlebitis and Venous Thrombosis.

Sixteen of our patients with venous thrombosis were seen or communicated with at a period of time, months or years after the onset of the complication. Ten of these cases were instances of femoral thrombosis; two, of double iliac thrombosis; two, of popliteal thrombosis; two, of thrombosis of the veins of the calf.

After history of 10 cases of femoral thrombosis. One of these two cases was seen two and a half months after convalescence, one, ten days after his discharge from the hospital, while two others were communicated with years after the onset by letter. The remaining six were examined at periods varying from two to twelve years after the affection.

In all instances there was more or less permanent disability.

In 6 cases there had been *œdema* lasting for from several weeks to two years.

In 5 cases there was a complaint of *cramps* in the calves, especially at night and after exercise.

In one instance the patient complained of sharp *pains* running up through the leg and thigh especially after standing.

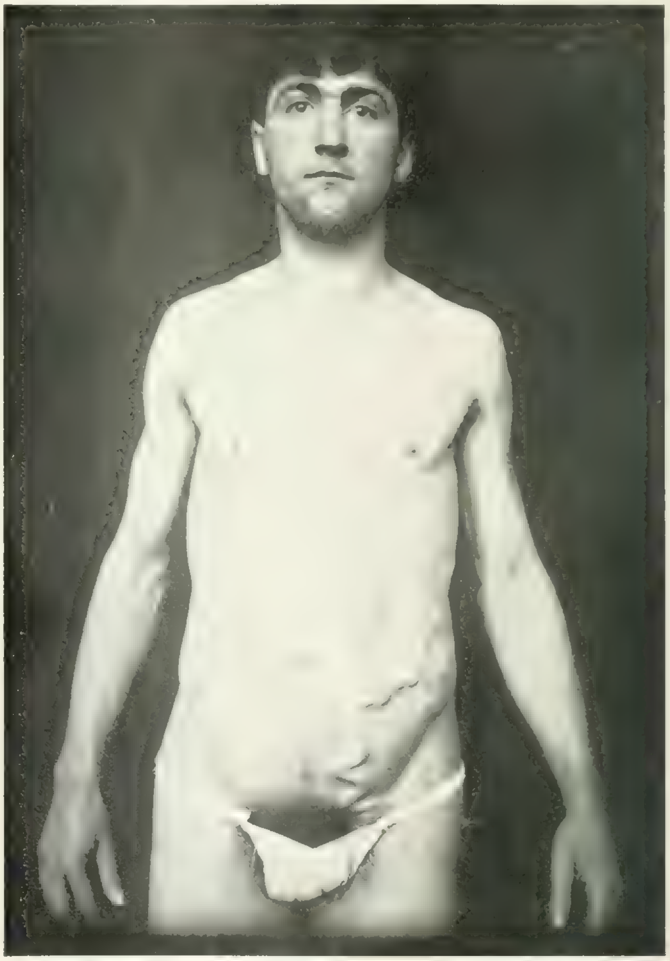
In one case the patient says that when he exercises his leg too much, "it becomes so weak that I can hardly use it; it seems to give out."

In every instance the affected leg and thigh were materially and permanently larger than the other.

In all cases, excepting in the instance seen ten days after discharge, there were marked *varicosities*. These were especially extensive in the calf, the popliteal space and on the posterior and inner side of the thigh. In 6 cases, all but one in which the condition was looked for, there was a well marked varicosity of the veins in the hypogastrium. This picture seems to be characteristic. The varicosities usually form a triangle with the apex a little below the umbilicus, the blood flowing from the affected thigh to the apex of the triangle and then down again into the opposite inguinal ring passing upwards evidently through the iliac vein of the other side. The one case in which these varicosities were missed was that of an ignorant colored man who was communicated with by letter.

After history of two cases of double iliac thrombosis. Two cases of double iliac thrombosis were seen several years after the onset of the complication. In one of these, the first symptoms of which had been abdominal pain with marked leucocytosis and the early appearance of rather prominent veins in the lower abdomen, the later, subjective symptoms were few. Extensive varicosities, however, developed in the veins of both legs and thighs, extending upwards over the abdomen and anastomosing with the internal mammary veins and other veins in the axilla.

Case XXX (No. 45899). The second case was that of a young man of 22 of good family and personal history, who had a severe attack of typhoid fever at the age of 17. On the 18th or 19th day of the disease, just before the temperature reached the normal point, there was severe pain in the left groin. A few days later, the temperature being normal, the patient got out of bed and walked about, committing also various indiscretions in diet. This was followed by a relapse, immediately after the onset of which there was swelling, redness and pain in the left groin. About a week after this there was pain and marked swelling of his right leg. There was almost complete loss of power, and it was not until four months later that he was able to go back to work. He had to use crutches for a month. In the erect posture, the legs were considerably swollen; great varicosities developed, and three ulcers appeared on the left leg. Varicosities in the abdomen appeared with convalescence from his relapse. The patient entered the hospital on the eighth of March, 1904, complaining of swelling and ulceration of the legs and abdominal varicosities. There was great distension and tortuosity of the veins of both legs and thighs, extending up over the abdomen and anastomosing with branches of the internal mammary veins. Large tortuous veins also extended up into the axillæ. The left leg was everywhere a little larger than the right. The accompanying photograph illustrates well the remarkable character of the varices and anastomoses.


Case XXX (No. 45899) of double iliac thrombosis with extensive abdominal varices.

After history of two cases of popliteal thrombosis. Two cases of popliteal thrombosis were seen several years after the onset of the complication. One of these patients had suffered no inconvenience whatever. In the other, the legs are somewhat weak and toward the end of the day, they are, at times œdematous. In both instances the affected leg is somewhat larger than the other, but in neither are there marked varicosities.

After history of two cases of thrombosis of the veins of the calf.—In one case, after leaving the hospital, there was considerable œdema with the development of several ulcers. At the present time there is a well marked varicosity of the veins of the inner side of the leg and in the popliteal space. The other patient was communicated with by letter. He states that the "leg from the knee down is the source of a little continuous annoyance; it itches and is frequently inflamed during the warm months. It often goes to sleep." The calf measures an inch and a half more than the other.

(7) Subsequent History of a Case of Typhoid Arteritis with Possible Parietal Thrombosis.

J. H. T. (*Case XVII,* page —), whose attack of arteritis of the left femoral with possible parietal thrombosis, has been previously described, returned on the 27th of March, 1904, in answer to a letter. He considered himself in good health and looked extremely well. He had recently entered the U S. Marine Corps. On inquiry, however, a history of typical intermittent claudication was obtained. "I am," he said, "standing or walking and all of a sudden, it" (the left leg) "gives way on me and I kind of fall." Several times when he has walked too much, his left leg has suddenly given way so that he has actually fallen down. At times, when, he tries to use it, there are sudden pains which shoot upward through his leg. Once when, as a printer, he was lifting a heavy form, the leg suddenly doubled up under him and the form fell upon his toe.

On examination the left thigh and leg were everywhere slightly larger than the right. The femoral pulsation appeared to be equal on both sides. In the popliteal, the pulsation was difficult to feel on either side. The pulsations of the dorsalis pedis were essentially equal. The posterior tibial pulsation, however, was very feeble upon the left as compared with that upon the right.

It is unnecessary here to refer again to the results of cerebral thrombosis.

V. Conclusions.

In considering this series of observations what information have we gained and what conclusions are we justified in drawing?

(1) Typhoid fever is a disease which, from a clinical standpoint, is often associated with symptoms suggestive of a grave weakening of the heart muscle. These changes, whether due primarily to direct action of the typhoid poison on the heart or to impaired nourishment from vaso-motor paralysis, result, in a considerable proportion of cases, in a temporary insufficiency of the mitral valve as indicated by the appearance of apical systolic murmurs which are, not infrequently, transmitted to the axilla. These murmurs develop especially at the height of the disease, during the latter part of the first and in the second, third and fourth weeks, and disappear usually with convalescence. Sometimes, however, they may persist.

12 out of 188 cases of typhoid fever who were followed from three months to fourteen years after convalescence, showed conditions suggestive of organic cardiac lesion. In the majority of these cases a systolic apical murmur had been detected during their illness.

Over one-fifth of our old typhoids in whom, during their illness, a systolic apical murmur was heard, showed on subsequent examination, evidence of organic disease.

The average systolic blood pressure (Riva Rocci) was higher in every decade among our old typhoids than in healthy individuals who had never had the disease.

The radial arteries were palpable with strikingly greater frequency in our old typhoids than in healthy individuals of the same age who had never had typhoid fever.

(2) Endocarditis, while not a common complication of typhoid fever, is probably more frequent than generally supposed. It was present without being suspected, in 3 out of 95 cases coming to necropsy at the Johns Hopkins Hospital, while in 3 further cases out of the remaining 1363, the clinical symptoms suggested its presence.

In the 3 cases discovered at necropsy, the lesion was due to a secondary mixed infection; in 2 instances, staphylococcus aureus; in one staphylococcus albus. It is not impossible that endocarditis is more frequent than indicated by these figures. Out of 188 old typhoids, 8 showed mitral insufficiency; one aortic insufficiency; one, possible mitral stenosis.

(3) Pericarditis is an unusual and unimportant complication of typhoid fever. Three instances only, were noted in our 1458 cases.

(4) Phlebitis and venous thrombosis is a frequent complication of typhoid fever, occurring in over 2.6 per cent of our cases.

The onset occurs usually in the third week or later, and is in most cases, associated with fever, leucocytosis and local pain. Not infrequently the fever and leucocytosis may precede the localizing symptoms.

The complication was ushered in by or associated with chills in 28.9 per cent of our cases.

Chills otherwise unexplained, occurring during the latter part of typhoid fever or in the early stages of convalescence, especially if associated with a leucocytosis, should always suggest the possibility of a developing phlebitis.

The phlebitis is, in the great majority of cases, localized in vessels of the lower extremity, especially on the left side, and is particularly frequent in the femoral veins—about one-half of our cases.

Thrombosis of the iliac and femoral veins is always a serious complication. Although the immediate dangers—gangrene, extension of the thrombus, pulmonary embolism—are not great, the after results are often grave.

In thrombosis of the femoral or iliac vein the affected extremity is always considerably and permanently enlarged, and there is usually more or less persisting disability—extensive varicosities, often resulting in ulceration; marked weakness of the limb; frequent cramps in the muscles, especially at night and after over-exertion.

(5) Arteritis and arterial thrombosis is a more frequent complication of typhoid fever than is generally recognized.

This complication appears to be especially common in the cerebral vessels although it may occur in the extremities.

The onset may occur at the height of the disease but is commoner in the third week or later. As in the case of phlebitis, the attack is often ushered in by fever and leucocytosis.

In the extremities arterial thrombosis is commonly followed by gangrene; in the cerebral vessels by hemiplegia.

Arteritis in the extremities may be associated with partial parietal thrombosis from which nearly complete recovery may occur. In one of our instances the patient, a year and a half after his fever, showed characteristic symptoms of intermittent claudication.

(6) A survey of our pathological material would suggest that typhoid fever may be a not infrequent cause of focal arterio-sclerotic changes.

In 21 out of 52 cases in which notes upon the condition of the aorta were made there were evidences of fresh endarteritis.

In 13 out of 62 cases in which the condition of the coronary arteries was recorded like changes were found.

This idea is further supported by the remarkable frequency with which sclerosis of the peripheral vessels was found in our old typhoids.

(7) While the deleterious influence of typhoid fever upon the cardio-vascular system is not as great as that of acute rheumatism, yet through the unfortunate frequency of the disease in this country, it is probable that post-typhoid cardio-vascular defects are not uncommon. It would be wise for the practising physician to bear this in mind and wherever possible, to keep his typhoid patients under observation for several years following the disease.

NOTES ON NEW BOOKS.

The Practical Medicine Series of Year-Books. Vol. VI, May, 1904: General Medicine. Edited by Frank Billings, M. D., and J. H. Salisbury, M. D. (*Chicago: The Year-book Publishers, 1904.*) Pp. 330.

This volume presents a well-systematized and judiciously selected condensation of the literature of the twelve months preceding its date, in the field of internal medicine. The new work that appeared during that time is presented without comment, and while few of the original articles abstracted suffer more than is necessary in the process of abbreviation, they all hang but loosely together. That compilations of this or similar sort are becoming yearly more indispensable to the busy practitioner, who would keep abreast of the times, is evidenced by the popularity which such works have already attained, even if it were not sufficiently indicated by the truly formidable size of the monthly parts of the *Index Medicus*. To one who has any "Trieb" towards the careful following of special subjects in the current journals, in addition to the call of his practical duty, these compends are both labor-saving and stimulating, enabling him to maintain an intelligent sympathy with workers whose opportunities are different from, or less limited than, his own. As a supplement to the *Index Medicus*—as an amplification of its bare and sometimes misleading titles—the Year-book and others of its class may even be of assistance to the more careful student in his search of the literature for special points of information.

But we should prefer a more synthetic method than has been employed. Unlike some similar publications, the editing of the Year-book has included no evaluation of the material presented; abstract follows abstract without any other relation than that of a common subject. More information of value could be given in a well-conceived critical review of one-half the length. However, the articles are in the main well chosen, and there is little lumber. The references should be more complete, and should follow the system of the Index Catalogue; but so far as we have had opportunity to verify them, they are correct. There is a good index. The paper and presswork are sufficient, considering the necessarily short life of usefulness of works of this class.

The Clinical Study of Blood-Pressure: a Guide to the Use of the Sphygmomanometer in Medical, Surgical, and Obstetrical Practice, with a Summary of the Experimental and Clinical Facts Relating to the Blood-Pressure in Health and Disease. By Theodore C. Janeway, M. D. Pp. XIII; 300. (*New York: D. Appleton & Co., 1904.*)

Dr. Janeway has accomplished a great work, uniting, digesting and grouping the scattered and ill-correlated observations of separate workers in a new field, and bringing their labors before us in an ideal fashion. Neglecting in no detail the ascription of each fact in its order to its proper author, he has recorded everything in the literature of clinical sphygmomanometry that deserves notice, and has drawn amply on the physiologists for criticism and control, making his book complete as a history of our knowledge of the pressure phenomena of the pulse. But far more than this, the author brings a wide personal experience of blood-pressure work to his aid in building up a clear, connected, and reasonable account of the value of the sphygmomanometer in practice, and points out in a way that cannot fail to excite much new and important research, the possibilities as yet undetermined of this, the latest of our instruments of clinical precision. What Wunderlich's great treatise was to clinical thermometry, Janeway's book will prove for clinical sphygmomanometry.

It is only three years since Cushing first brought to this country a Riva-Rocci instrument, and began its systematic use in the surgical wards and operating rooms of this hospital. Dealing with a group of cases that perhaps more than any others are liable to swift and dramatic changes in blood-pressure, Cushing was able to demonstrate the wide utility of the instrument. Since that time Crile, Cabot, and a number of others, have made use of blood-pressure determinations in the clinic, and the new points of attack thus obtained in questions of diagnosis and treatment have led to more detailed studies of the subject than had hitherto been attempted in this country. All this work, as well as that of the earlier and more recent European authors, is fully brought out in the book before us.

Giving up one-third of his space to consideration of the physiological and technical principles involved in the measurement of the blood-pressure in man, Janeway has succeeded in a clear presentation of the most difficult part of his subject. Without going too deeply into the laboratory side of the study of the action of the cardio-vascular mechanism, he has brought out in emphatic relief the physiological fundamentals of knowledge, without which the sphygmomanometer is but a broken reed to lean on in the clinic, and its use unjustified. If any one part of the present work is essential, it is the first section, for the failures and disappointments that we have seen in the study of pulse phenomena by this instrument have in nearly all instances been due to ignorance on the part of the observer of the usual sources of error, whether in the instrument itself or in the interpretation of its figures.

The various sphygmomanometers in common use are described in detail, and Janeway illustrates a new one of his own design, which, except in one regard, is decidedly the best yet devised for bedside use. Its one drawback is that it is not conveniently portable, and for general use outside of hospitals, we still prefer Cook's modification of the original Riva-Rocci type. True, the new instrument is adequate to the determination of minimum, and hence of mean, arterial pressures, as well as to systolic or maximum measurements; but as in the vast majority of instances all the important clinical information can be drawn from a knowledge of the state of, and the changes in, systolic blood-pressure, the Janeway sphygmomanometer is really less useful than a compact one like Cook's. It has been known for some time that the width of the pressure armlet has, within limits, an influence on the height of the readings obtained with this type of instrument; and if conviction were needed in the matter, Janeway has certainly produced it, and shown that no instrument should be used for other than relative readings that does not employ an armlet at least 10 cm. wide.

The clinical portion of the book is fascinating. A mass of material is presented, much of it original, that cannot fail of itself to excite a great interest among internists and general surgeons alike. But it is in the manner of presentation and correlation of this material that the author has excelled, and may be fairly said to have attained a classic level. The system of his work lends clearness and intelligibility to intricate problems; the emphasis of detail is never tiresome, but always just and illuminating; the charts are well chosen and well drawn. The summary at the head of each chapter makes the book easy to read, and gives consistency to one's general view of the subject treated. The index is ample, the literature tables are exhaustive and the references conveniently placed.

The author's views are so correct, his opinions of the disputed and undecided questions are so just, his enthusiasm is so well controlled, that he leaves one no room or opportunity for criticism. It is a good book, well written, on a vitally interesting subject.

Clinical Treatises on the Pathology and Therapy of Disorders of Metabolism and Nutrition. Part III. Membranous Catarrh of the Intestines. By C. von Noorden, with the collaboration of Dr. Carl Dapper. Pp. 64. (*New York: E. B. Treat and Co., 1903.*)

Muco-membranous Entero-colitis: Symptoms, Complications, Etiology, and Treatment. By M. de Langenhagen, M. D. Pp. VI; 115. (*London: J. and A. Churchill, 1903.*)

A comparative reading of these two little books offers a strong lesson in method and in the value of the open mind. De Langenhagen, who is a resident at Plombières, in reviewing a personal material of over 1200 cases of mucous colic, is led by the ignis fatuus of arthritism to mistaken judgments concerning etiology and treatment, to imperfect analysis of his large series of cases, and to conclusions that lack correlation and the quality of bringing conviction to the reader. The work of v. Noorden and Dapper, on the other hand, based on a group of less than eighty cases, is a model of clinical style and a source of profit and satisfaction in the reading.

Taking a broader view perhaps, but certainly a less accurate one, than that of the two German clinicians, de Langenhagen attributes all but the most exceptional instances of "muco-membranous entero-colitis" to the malign influence of that diathetic abstraction, "neuro-arthritisme," which has so much power over the minds of many French internists. His picture of the disease, though rather overburdened with accessory detail, is accurate and generally clear, but we cannot agree with the author as to the constant concurrence of general enteroptosis with the affection under consideration. It is with regard to the views of causation and treatment expressed that the French brochure is most unsatisfactory. Local treatment of the bowel itself is well discussed; but we do not think that the recommendation of an unirritating diet poor in residue, and of drug control of the attendant constipation, would meet with general favor. The neurotic element in the disease is recognized, and treatment away from home is advised, perhaps not without regard to the author's position at a prominent watering-place, where the various hydrotherapeutic measures recommended can be best carried out.

The translation is atrociously bad, the reader's attention being constantly diverted from the subject-matter by the grotesque picture of Gallic idiom faithfully preserved in the unsympathetic menstruum of the English vocabulary.

The English version of Part III of v. Noorden's series of small handbooks suffers less in translation than does its French companion. The paper and presswork are hardly worthy of the matter which they present, but the form of the book is convenient. About half of its pages are taken up with a consideration of the pathology, and a condensed but ample discussion of the older and the more recent literature. The term "mucous colic," which is used, seems more acceptable than that of mucous colitis as a name for a condition whose actual inflammatory nature is, to say the least, not proven, and it is the one name that most exactly pictures the cardinal symptoms of the disease.

v. Noorden finds that in all cases there has been precedent constipation in persons of a neurotic disposition. But only a few constipated neurasthenics have mucous colic; and the authors are far from recognizing with Boas this highly characteristic symptom complex as simply dependent upon the presence of scybala in the bowel. The link connecting the sluggish action of the bowels with the abnormal general nervous state in the production of the symptom picture, they find in an involvement of the nerve mechanism governing the secretion of mucus in the large intestine, so adopting Nothnagel's postulate of a secretory neurosis. That a sensory intestinal neurosis co-exists, or at least that the mere presence of mucus adhering to the bowel wall causes sensory symptoms of a severity greater than would be the case in persons of a stable nervous constitution, seems admissible.

The therapy suggested, one which has probably been as widely accepted as any, can be summed up in very few words. It consists in coarse diet, and the prohibition of cathartic drugs, with, of course, appropriate measures directed to the general nervous system. The essential feature in treatment should be the relief of the constipation by means of food rich in cellulose—a re-education, as it were, of the bowel wall. High oil enemata are favorably considered in the early stages of the "cure" but the use by rectum of solutions having any irritant properties at all is not encouraged. When on the diet recommended, which is well summarized without iron-bound prescription of detail, daily soft evacuations are obtained, the patient's general condition improves, and as his state of nutrition is bettered the whole symptom-complex disappears. By these methods the authors were able to obtain complete recovery in 79 per cent of their cases—complete and permanent recovery in just one-half of the whole number treated.

Only casual attention is given in these works, written as they are from a purely medical standpoint, to the forms of mucous colic associated with ovarian tumors or disease of the uterine adnexa.

Both of these booklets would be better for even brief and general indexes; the tables of contents do not cover the deficiency.

The Skin and Venereal, Nervous and Mental Diseases. Edited by W. L. Baum, M. D., and Hugh T. Patrick, M. D. The Practical Medicine Series of Year-books. Edited by Gustavus P. Head, M. D. (*Chicago: The Yearbook Publishers, 1903.*)

The value of this little book lies, of course, in the opportunity it affords of ascertaining at a glance the outlines of the most recently acquired knowledge upon the subjects which it considers, as well as of obtaining correct references as to where such knowledge can be obtained in full without further trouble. Its purpose and scope are so general that it would not be suitable or profitable to review it in detail. All that can be said here is that the items selected for comment are chosen with judgment, and they are discussed in a very satisfactory manner. The compilation is most useful to the busy practitioner.

Epilepsy and its Treatment. By William P. Spratling, M. D., Superintendent of the Craig Colony for Epileptics at Sonyea, N. Y. Handsome octavo volume of 522 pages, illustrated. (*Philadelphia, New York, London: W. B. Saunders & Company. Baltimore: Medical & Standard Book Co., 1904.*)

This is the first complete treatise on Epilepsy since the appearance of Echeverria's work, published over 33 years ago, and represents the practical experience of Dr. Spratling as Superintendent of the Craig Colony for Epileptics at Sonyea, N. Y., during a period of ten years.

This book is well-printed and well-illustrated and presents an attractive appearance. It contains a wealth of clinical experience presented in such a manner as to command the attention of the general practitioner. It is in fact more a book for the practical man than for the student. It is written in a popular style and is very readable.

In the line of treatment little that is new is presented. The chapter on the results of surgical interference is substantially the same as the one which was published in the *American Journal of Insanity* last year. The ultimate results of all sorts of surgical interference do not seemingly justify the surgeon in promising much benefit. The chapter on the medical treatment presents a similarly discouraging prospect. From a careful reading of the book one is impressed with the conviction that more is to be expected from open-air life, good hygienic conditions, freedom from worry and adjusting the patient to the life of an invalid requiring custodial care and parental guidance rather than medicine or surgical interference.

The descriptions of disease conditions are excellent and the whole book indicates a careful systematic study of the subject. The State of New York has reason to be proud of the character of the work done at Craig Colony. It is evident that here the foundations are being laid for a fuller knowledge of the disease and a scientific mode of treatment.

Burdett's Hospitals and Charities, 1904. Being the Year Book of Philanthropy and the Hospital Annual, containing a review of the position and requirements and chapters on the management, revenue and cost of charities. An exhaustive record of Hospital Work for the Year. By Sir Henry Burdett, K. C. B. (*London: The Scientific Press (Limited), 28 & 29 Southampton St., Strand W. C.*)

The most interesting feature of the present Annual is an elaborate discussion of the space requirements of the modern hospital. From this it appears that St. George's Hospital has a site area of 191 superficial feet per patient; Westminster Hospital has 134 feet; The Royal Free Hospital has 253 feet; Middlesex Hospital has 267 feet; St. Mary's Hospital has 136 feet; Charing Cross has 86 feet; University College Hospital has 160 feet; Guy's Hospital has 364 feet; St. Thomas's Hospital has 652 feet, and St. Bartholomew's Hospital, when the recent additions made to the site are utilized, will have 420 feet per bed. The contention of the Annual is that no hospital ought to have less than 450 superficial feet per bed and that consequently St. Thomas's is the only London hospital with a medical school attached which possesses a site which at present fulfils this essential requirement of modern science. The writer adds that "formerly 300 superficial feet per bed were regarded as enough for a town hospital; but the continuous increase in the demands for special departments, and above all for the complete aëration of every building occupied by patients, has produced results which raise the minimum of efficiency to 450 superficial feet per bed. In the case of a virgin site upon which it is possible to plan a hospital and medical school in its entirety, it is possible to so arrange the accommodation in the various buildings that every available foot of the site shall be utilized to the best advantage. In London, owing to the circumstances we have already referred to, with the exception of St. Thomas's Hospital, the medical school buildings have been added from time to time and were probably not contemplated when the hospital buildings were first planned and erected. This accounts, too, for the position in which two of the larger hospitals stand with regard to this question. We have taken out the figures and we find that upwards of 56 per cent of one site is occupied by buildings, although the ward blocks, theatres, etc., occupy less than 16 per cent of the whole available area, against about 20 per cent, or one-fifth of the site which is covered by medical school and kindred buildings. We mention this to show that whereas for a town hospital the unit has been roughly, 100 beds per acre of site, if such a hospital has a medical school attached to it the unit must be increased to something like 50 or, at the outside, 60 beds per acre."

The remedy proposed by the writer is to consolidate the teaching in fundamental branches during the first two years of the medical curriculum and to use hospitals wholly for medical teaching. This will do away with the duplication of buildings and leave the grounds of the hospitals less cumbered with buildings which have no connection with the clinical study of medicine.

The Annual for 1904 is filled with interesting and valuable statistics. It should be in the hands of every hospital officer.

University of Pennsylvania: Contributions from the William Pepper Laboratory of Clinical Medicine. No. 4. (*Philadelphia, 1903.*)

This is a formidable collection of reprints of articles written by the various workers in the Pepper Laboratory. At least one-half is devoted to a series of interesting neurological cases reported by W. G. Spiller. One of the more important is a "Report of Two Cases of Multiple Sclerosis with Necropsy." In America there have only been three such cases reported. The author's first case was clinically and pathologically typical. The second had several unusual features, viz., pronounced muscular atrophy, secondary degeneration of the crossed pyramidal tract, and almost complete internal ophthalmoplegia resulting from sclerosis in the nuclei of the 3d, 4th and 6th nerves.

Another paper by Spiller and Hendrickson on "Multiple Sarcomatoses of the Central Nervous System" is worthy of attention. Two cases are reported at great length and their histological characters clearly depicted. McCarthy, in a paper on the "Formation of Hæmolymph Glands from Adipose Tissue in Men," confirms clinically Warthin's recent experimental work in sheep and goats. Both were cases of Adiposis dolorosa, in the fat of which newly-formed hæmolymph tissue was found. Evans and Sailer report a "Case of Colon Infection Simulating Typhoid Fever." The patient had fever for four weeks, enlarged spleen, rose spots, and a mild relapse. The serum agglutination test was negative to *B. Typhosus* and four strains of *B. Paratyphosus*, but positive to *B. Coli communis* in high dilutions (1:150) in one hour. A control with four typhoid sera was negative. The more absolute proof—the isolation of *B. Coli* from the blood—was wanting.

Stengel and White report a remarkable case of "Chronic Acetanilid Poisoning with marked alterations in the Blood." The patient was a girl of 25 years who for four years had been suffering with infradental neuralgia, for which she had taken chloral, hyoscyamine, as well as acetanilid in large doses over a period of three years. She had marked cyanosis, cardiac, hepatic, and splenic enlargement, but no dyspnœa or œdema. The blood showed a marked secondary anæmia with great numbers of nucleated red cells (25,000 to 75,000 per cmm.), of which 91.4 per cent were normaloblasts, and 3.5 per cent megaloblasts. With the withdrawal of the drug the patient made a complete recovery.

Medical and Surgical Report of the Presbyterian Hospital in the City of New York. Vol. VI. January, 1904. Edited by Andrew J. McCosh and W. Gilman Thompson. (*New York: Trow Directory Printing and Bookbinding Company.*)

This compact volume contains many useful contributions, and is a credit to the institution which gave it birth. The first article is a statistical study, by Tuttle and Carter, entitled "Data regarding Acute Lobar Pneumonia" at the Presbyterian. In a period of about six years 600 cases of acute lobar pneumonia were treated (as compared with 8470 admissions), with a mortality of 34.8 per cent. Two-thirds of the cases occurred from December to May inclusive. It is interesting to note that 18 cases were complicated by empyema, with one death. More than 12 per cent received *no* medical treatment whatever, while of the remainder the great majority received only symptomatic treatment. Ellsworth Eliot, in an article entitled "The behavior of the Costal Arch in Diseases of the Abdominal Organ," describes a new method of examination—the determination of the resistance of the costal arch by means of palpation, with one hand on either half of the arch. He finds that the resistance can always be elicited in acute and subacute processes of the contiguous organs in the upper half of the abdomen, and that the degree is in direct ratio to the intensity of the process.

John Howland gives a résumé of "The Pathological Anatomy of the Shiga Bacillus Infection of the Intestines in infants." Among 32 autopsies from three of the New York hospitals, tne organism was found (either clinically or post-mortem) in the great majority, and proved to belong to the "Harris" or "Flexner-Manila" type, i. e., it fermented mannite with acid formation. "A contribution to Cyto-Diagnosis in Pleural Effusion with especial reference to the Tubercular Form," by H. S. Carter, is, in our opinion, the most important article in the book. After a study of 36 cases (10 of effusion of undoubted tubercular origin, 19 of probable tubercular origin, 3 of serous effusion after pneumonia, and 4 of transudation in cardiac or renal disease), he concludes (1) that a true pleural effusion has a specific gravity over 1010, a high fibrin and albumin content in contrast with a pleural transudate (2) that an absolute diagnosis of tubercular pleurisy can be made by a morphological examination of the fluid, and rests upon a high specific gravity (1012-1024), a high amount of fibrin and albumin with an accompanying lymphocytosis.

Ingen and Frissell report "A House Epidemic of Paratyphoid Fever," in one of which the organism was isolated post-mortem. The details of the autopsy are interesting as the case showed no apparent change in Peyer's patches, but several punched-out ulcers near the iliocæcal valve.

The last article is a "Report on Malignant Endocarditis, with a collection of Thirty-two Cases," by M. H. Sicard. There were six cases due to the staphylococcus, three to the pneumococcus, and two to the streptococcus, in all of which the organism was isolated either during life from the blood, or at autopsy. The remaining twenty-one cases did not show an organism, but the diagnosis was based upon other data. Of the 32 cases, 8 occurred coincidently with rheumatism and 7 gave a previous history of such, so that endocarditis was a pre-existing factor in the majority. Among 19 autopsies there were 16 with emboli. Hæmorrhage occurred in 16 cases; and a leucocytosis of at least 15,000 per cmm. in all but one case.

International Clinics: A Quarterly of Illustrated Clinical Lectures and Especially Prepared Original Articles on Treatment, Medicine, Surgery, etc., by leading members of the Medical Profession. Edited by A. O. J. Kelley, Philadelphia. Vol. I. Fourteenth series, 1904. (*Philadelphia: J. B. Lippincott Company.*)

Space does not permit even a cursory review of each interesting and instructive paper that is included in this volume. Only the most important will receive attention.

In the section on Treatment, by far the most important paper is that by Widal and Javal of Paris, "The Chlorid Reduction Treatment of Parenchymatous Nephritis." The authors show that the degree of albuminuria follows the oscillations of the chloride retention curve, and that the tissue hydration and dehydration follow the giving or withdrawing of chlorides. A chloride reduction must be insisted upon at certain times in the diet of cases with parenchymatous nephritis. This can be arrived at by means of a pure milk or even a meat diet *lacking in chlorides.* Further, they emphasize that the determination of the amount of chlorides excreted is of no value, except in relation to the chlorides absorbed. In addition, they show that albuminoids of animal origin (as of milk) are less harmful than those of meat, because of the salt that is added to the latter.

In a "Clinical Study of Adonidin," R. W. Wilcox shows that it is indicated in cardiac disease, in which a rapid pulse of low tension is a notable feature, and that the drug possesses certain advantages over digitalis,—its action being more permanent and less vaso-constricting than the latter.

The article entitled "The Therapeutic Application of Colloid Silver," is interesting but not convincing. More experimental work has yet to be done and some rational explantion for its action offered before the exhibition of the drug will receive the support of the profession.

Two papers on the treatment of neurasthenia in general, and of gastric neurasthenia in particular, bring forward nothing new. The author of the latter seems to overvalue electricity as a therapeutic agent.

Davis, of Chicago, in the section on medicine points out that "the increased prevalence and mortality of pneumonia during the last sixty years," is due not to any climatic or dietetic change, but to the lowered resistance of the community from a more general use of alcohol and migration of youth of both sexes from country to town. In the outline of the various methods of treatment, he deplores the use of "alcoholic and other anæsthetic drugs" in the course of the disease.

Walsh, of New York, in "The Early Diagnosis of Pulmonary Tuberculosis," emphasizes the importance of inspection and auscultation of the chest, the rapidity of the pulse, and the persistent slight loss in weight—data which enable one to make a diagnosis even in the absence of bacilli in the sputum.

The section on Surgery contains a paper by Beck, of Chicago, on "Angioma and its treatment," and also discusses the pathology and etiology of these tumors; he makes a plea for their radical treatment by extirpation. Of more general interest are the papers on "Intestinal Anastomosis" and "The Complications met in the Surgical treatment of Diseases of the Testicle."

The section on Gynecology is devoted, strangely enough, to two papers on "the Non-operative treatment of Inflammations of the Genital Tract" and "of Chronic Ovarian Lesions."

In the section on the "Progress of Medicine," the literature of the year is reviewed, and the more important contributions are detailed. Thus, the importance of the house fly in dissemination of typhoid fever was emphasized by Hamilton and Turner; the bacterial origin of acute rheumatism is supported by Ainley Walker and F. Meyer, but contradicted by C. Philipp, who believes that rheumatism is a "morbus sui generis." R. L. Jones reports a series of cases in which Graves' disease and arthritis deformans occurred together, and believes that a definite relation exists between the two.

The section on the "Progress of Surgery" by Bloodgood is very exhaustive and merits a careful perusal, especially the article on the Surgery of the Stomach. Surgery has been making tremendous strides in the treatment of simple ulcer and cancer of the stomach, thanks to such men as Mikulicz of Germany, Moynihan and Robson of England, and the Mayos of America. Operative interference for gastrorrhagia is considered more justifiable than formerly, and the operation of choice is a gastro-enterostomy, thereby procuring physiological rest and so affording an opportunity for the healing of the ulcer. A résumé of Brunner's communication on "Gastric Perforation" receives especial attention. The plates illustrating the article on Cancer of the Stomach are very beautiful and instructive.

The section on "Treatment," by Stevens, includes an epitome of the various drugs and antitoxins in vogue, and the special indications for their use.

C. P. Howard.

BOOKS RECEIVED.

Scientific Memoirs. By the Officers of the Medical and Sanitary Departments of the Government of India. (New Series.) No. 7. *Some Observations on the Poison of the Banded Krait (Bungarus Fasciatus).* By Captain George Lamb, M. D. (Glag.), I. M. S. Issued under the Authority of the Government of India, by the Sanitary Commissioner with the Government of India, Simla. 1904. 4to. 32 pages. Office of the Superintendent of Government Printing, Calcutta.

A System of Physiologic Therapeutics. Edited by Solomon Solis Cohen, A. M., M. D. Volume VIII, *Rest, Mental Therapeutics, Suggestion.* By Francis X. Dercum, M. D., Ph. D. 1904. 8vo. 332 pages. P. Blackiston's Son & Co., Philadelphia.

The Therapeutics of Mineral Springs and Climates. By I. Burney Yeo, M. D., F. R. C. P. 1904. 12mo. 760 pages. W. T. Keener & Co., Chicago.

Saint Thomas's Hospital Reports. New Series. Edited by Dr. H. P. Hawkins and Mr. W. H. Battle. Volume XXXI, 1902. 8vo. 136 + 405 pages. 1904. J. & A. Churchill, London.

Progressive Medicine. A Quarterly Digest of Advances, Discoveries, and Improvements in the Medical and Surgical Sciences. Edited by Hobart Amory Hare, M. D., assisted by H. R. M. Landis, M. D. March 1, 1904. 8vo. 337 pages. Lea Brothers & Co., Philadelphia and New York.

Manual of Materia Medica and Pharmacy. Specially Designed for the Use of Practitioners and Medical, Pharmaceutical, Dental, and Veterinary Students. By E. Stanton Muir, Ph. G., V. M. D. Third edition, revised and enlarged. 1904. 8vo. 192 pages. F. A. Davis Company, Philadelphia.

The Infectivity of Enteric Fever. With Observations on its Origin and Incidence at Caius College, Cambridge, Festiniog and Wicken-Bonant. By Alexander Collie, M. D. (Aberd.). 1904. 8vo. 47 pages. John Wright & Co., Bristol; Simpkin, Marshall, Hamilton, Kent & Co., Ltd., London.

Orthman's Handbook of Gynæcological Pathology. For Practitioners and Students. Translated by C. Hubert Roberts, M. D. Lond., F. R. C. S. Eng., M. R. C. P., assisted by Max L. Trechmann, F. R. C. S. Eng., M. B., C. M. Edin. 1904. 8 vo. 127 pages. John Bale, Sons & Danielsson, Ltd., London.

A Practical Treatise on Medical Diagnosis. For Students and Physicians. By John H. Musser, M. D. Fifth edition, revised and enlarged. Illustrated with 395 wood-cuts and 63 colored plates. 1904. 8vo. 1213 pages. Lea Brothers & Co., Philadelphia and New York.

Scientific Memoirs. By the Officers of the Medical and Sanitary Departments of the Government of India. (New Series.) No. 8. *A Preliminary Report on a Parasite Found in Persons Suffering from Enlargement of the Spleen in India.* By Lieut. S. R. Christophers, M. B., I. M. S. Issued under the Authority of the Government of India by the Sanitary Commissioner with the Government of India, Simla. 1904. 4to. 17 pages. Office of the Superintendent of Government Printing, Calcutta.

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AN EARLY CASE OF ULCER OF THE STOMACH.[1]

By Joseph C. Bloodgood, M. D., Baltimore.

(*Single. Situation: Lesser Curvature, 4 cm. from Pylorus. Clinical and Gross Pathological Diagnosis: Doubtful. Operation: Pylorectomy. Recovery.*)

The case which I am about to report is of interest because of the short duration of the symptoms, 3 weeks, and the difficulty of making a positive diagnosis of the indurated tumor situated in the lesser curvature of the stomach.

Clinical History.—The patient was a white male, 33 years of age. Eight years ago this patient came under my observation with a sinus communicating with one of the ribs on the left side. The history suggested tuberculosis. Slight pain had been the symptom of onset, some 4 months ago. Following this the formation of a chronic abscess, which ruptured spontaneously two months ago. At the operation the sinus was lined by hemorrhagic granulation tissue, situated on a very fibrous base. The sinus had two or three branches; one extended to the fifth rib, but the bone lesion had healed. Microscopically we were unable to demonstrate tubercle bacilli, or the histological lesion of tuberculosis.

Since this operation the patient has been well until three weeks ago.

His occupation is that of a laborer in an iron foundry. His daily work is very hard and he is exposed to extreme degrees of heat. He states, however, until three weeks ago he experienced no pain or discomfort in the abdomen, and no indigestion. He thinks perhaps that for a few months previous his appetite was not as good as formerly.

Present Illness.—Three weeks ago (he is quite positive as to the time) he began to suffer discomfort in the epigastrium. The area of discomfort was about 8 x 8 cm., beginning below the ensiform cartilage. The pain was not referred. All this discomfort, which has been pretty constant, was worse after eating. After a few days he began to vomit at night, vomiting being rarely present except at this time. The vomitus seldom contained undigested particles of food; was moderate in amount, usually watery in consistency, and with the acidity characteristic of ordinary gastric juice. The discomfort in the epigastrium continued in spite of the fact that the patient discontinued work and practically stopped eating solid food. After restricting his diet the amount of material vomited was less. A day, however, did not pass in which there was not one or more attacks of vomiting.

The patient is a spare, muscular man with no excess of fat. He thinks, however, that he has lost some flesh, but not sufficient to be noticeable.

Examination.—Color good, tongue clean. Facial expression gives no evidence of pain. The patient states that he is suffering from pain in the epigastrium, and places his hand midway between the ensiform cartilage and umbilicus. The pain is present equally on both sides of the medial line. Inspection, negative. Practically no subcutaneous fat.

Palpation.—There is perhaps slight resistance of the recti muscles above the umbilicus, but none of the lateral abdominal muscles beneath the ribs. In spite of this slight resistance, fairly deep palpation is possible, but as one is unable to palpate either the pulsations of the abdominal aorta or the spinal column a small tumor could easily be present.

---

[1] Reported before the Johns Hopkins Hospital Medical Society, May 16, 1904.

Percussion.—On percussing the epigastrium I was at once struck with the absence of the usual epigastric tympany. The entire epigastrium corresponding to the usual position of the normal stomach was flat except a small triangular area situated to the left of the median line along the border of the ribs, beginning at the ensiform cartilage. This note of tympany shifted to the right of the median line when the patient was turned on his left side, and moved slightly beneath the ribs when the patient was turned on his right side. This clinical sign suggested an increase in the amount of gastric juice.

The patient was admitted to the Union Protestant Infirmary on April 19, 1904, put to bed and given by mouth nothing but boiled water and albumin. Unfortunately, an examination of the gastric contents was not attempted until two days later, and at this time none of the contents of the stomach could be obtained. However, as at the operation, after three days of restricted diet, and after 24 hours of practically no fluid, there was found in the stomach about 200 cc. of residual fluid, lighter in color than normal gastric juice, with slight increase of acidity in which hydrochloric acid was present.

Clinical Diagnosis.—The brief duration of the disease in a man of 33, the distinct local symptoms, and the absence of a history of alcoholic indulgence, pointed with a good deal of certainty either to an ulcer or a cancer. In my judgment there were sufficient indications for an exploratory laparotomy. I explained to the patient, it was probable that under rest in bed and rectal feeding he would improve if the disease were an ulcer; but there were great probabilities of a recurrence of the symptoms; that if he subjected himself to operation the risk would be slight and the loss of time less, and a far better assurance of a perfect cure than after medical treatment. In addition, if the disease proved to be cancer, his chances of a cure would be greatly increased by an immediate operation at this early stage. The patient chose to undergo an operation.

Operation.—April 22, 1904. Anesthetic, ether. The anesthetic was well taken and there were no complications. The abdomen was opened through the belly of the right rectus muscle. There was very little subcutaneous fat. On opening the abdomen I was struck with the absence of pro-peritoneal fat so frequently observed in the epigastrium, and scanty fat in the omentum. The incision exposed at once the pyloric end of the stomach. One could see at the lesser curvature, about 4 cm. from the pylorus, a swelling involving the anterior portion of the stomach. The center of the tumor corresponding to the attachment of the lesser omentum was umbilicated. The peritoneum and fatty tissue in the omentum were retracted in this direction, a condition most frequently observed in the connective tissue around carcinoma, but one which I have observed in the omentum, chronically inflamed and adherent to an inflamed gall bladder or appendix. The peritoneum over the anterior portion of the tumor was darker in color than that over the normal stomach, and looked edematous. There was no special engorgement of the vessels over the tumor. On palpation the tumor was hard as a scirrhus carcinoma, and apparently disk-shaped, about 3 cm. in diameter and 1 cm. in thickness. The induration involved chiefly the anterior wall of the stomach and extended slightly to the posterior wall. The fat in the lesser omentum was indurated and adherent to it. A most careful palpation gave me an impression that I was dealing with a carcinoma. However, invaginating the normal anterior wall of the stomach against the mucous membrane surface of the tumor, and holding the tumor with the left hand, I could place the index finger of the right hand in a cavity which easily admitted the end of the finger. The wall of this cavity felt smooth and hard. I could palpate the smooth, slightly elevated mucous membrane about this cavity, which mucous membrane was adherent to the surrounding tumor mass. After this examination it seemed to me that the characteristics could be explained more easily by the theory of a simple chronic ulcer surrounded by a zone of inflammatory tissue. In carcinoma secondary to a simple ulcer in the majority of cases one gets a history of disease of much longer duration, and as a rule the ulcer is not so deeply excavated, and has not such a smooth surface. Inspection and palpation demonstrated the absence of enlarged glands in the lesser curvature. However, in the greater curvature, beginning at the pylorus and extending half the length, there were a number of enlarged glands, the largest 1 cm. in diameter, situated near the pylorus. This gland was removed, and on section showed no evidence of metastasis. It was soft and did not show much increase in fibrous tissue. As a rule a gland of this size would, if it contained cancer nests, have a distinct naked-eye appearance.

Although the gross appearance and the findings on palpation were in favor of an ulcer, I considered there was sufficient doubt to justify a complete operation. A resection was done in the ordinary manner. On account of the probable character and situation of the tumor, the division was made between the pylorus and duodenum. At the lesser curvature the stomach was divided about 4 cm. from the tumor, at about the position of the anterior branch of the gastric artery. From this point the incision extended at an angle a little to the right of the vertical line, so that less of the greater curvature was removed than is usual in carcinoma. With the greater curvature a part of the omentum and all the enlarged glands were removed. After removal of this portion of the stomach it was found that the stomach at the position of the greater curvature could be sutured so easily and without tension to the duodenum that the original method of Billroth was employed. In closing the stomach and in performing the end-to-end anastomosis between the stomach and duodenum, two rows of sutures were employed, continuous catgut passing through all the walls, reinforced by interrupted mattress sutures of fine black silk. The abdominal wound was closed without drainage. See Figs. 1 and 2, Plate XXIX.

Convalescence.—After operation there were no complications except slight nausea and vomiting up to the tenth day, when the patient was given much liquid by mouth. After the

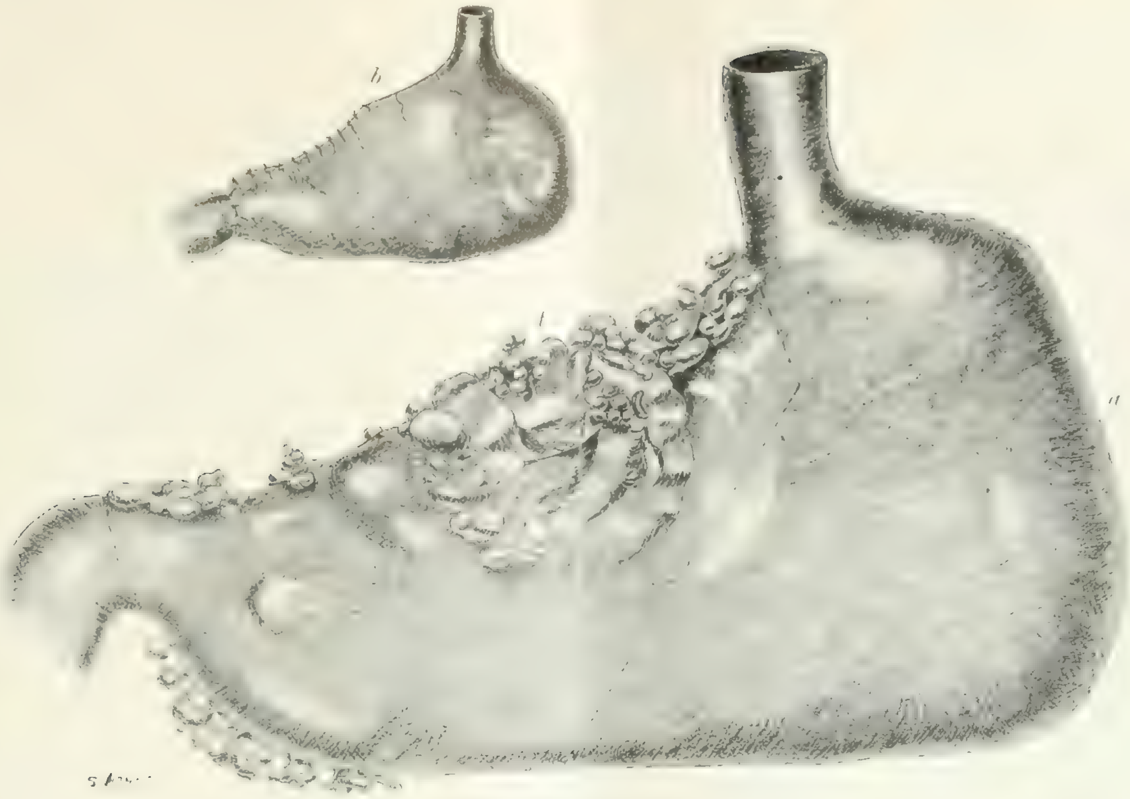

FIG. 1.

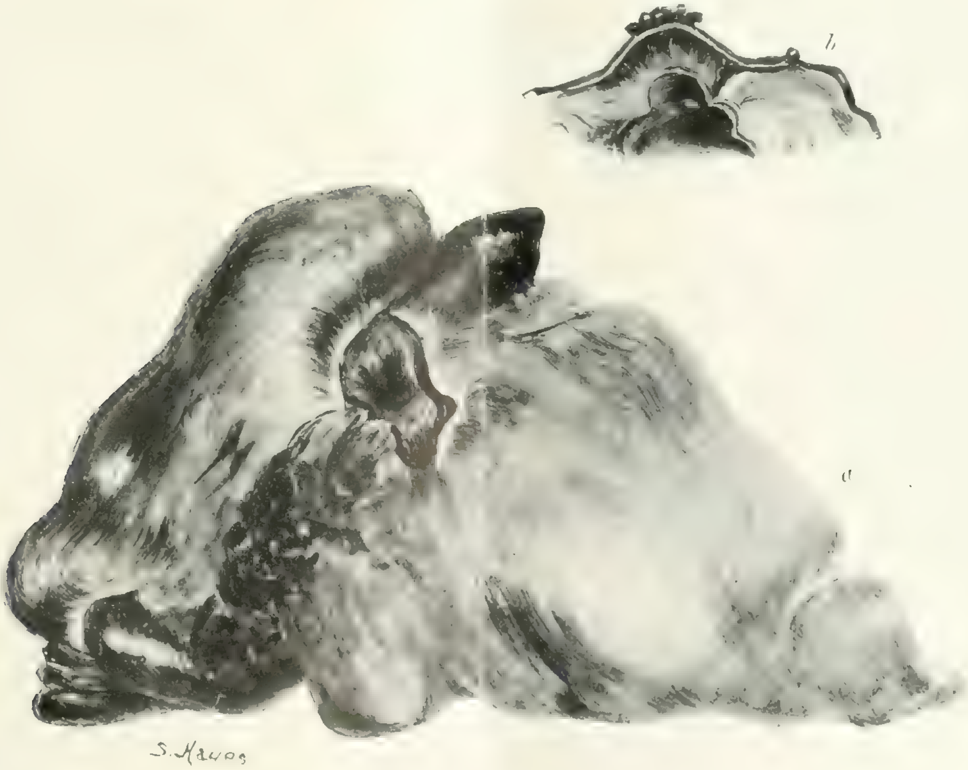

FIG. 2.

FIGURE 1. (a) Stomach before operation. (t) Visible and palpable tumor.
(b) **Stomach after operation.**

FIGURE 2. (a) Inside view of stomach showing ulcer.
(b) Section through stomach wall and base of ulcer.

second week he retained food taken by the mouth, which was gradually increased.

The wound healed per primam.

NOTE.—July 26, 1904. It is three months since operation. The patient has been at work for six weeks, has gained 30 lbs. in weight and states that he suffers absolutely no epigastric distress. He has an excellent appetite and can eat anything he wants. (Oct. 20, 1904. He remains well.)

Gross Pathology.—The naked-eye appearances are characteristic of an excavated chronic ulcer. On inspecting the tumor from the stomach side a cavity is seen which about admits the end of the index finger. The mucous membrane surrounding it, appears normal. It extends a little over the edge of the cavity, becomes thin, ends abruptly in a smooth finely granular granulation tissue lining the remainder of the cavity. The mucous membrane about the cavity is a little elevated. There is no evidence of any attempt at epithelial growth over the ulcer surface. On section one sees beneath the surrounding mucous membrane and the surface of the ulcer a wide zone of dense white fibrous tissue, which extends between the mucous membrane and peritoneum, and between the ulcer surface and the peritonum. In this fibrous tissue one can recognize nothing of the muscular coats of the stomach. There is no increase in vascularity. The distance between the mucous membrane and border of the ulcer and the peritoneum is about 1.5 cm.; between the base of the ulcer and the peritoneum about 4 mm.; so that there was but 4 mm. of connective tissue preventing a perforation. The hemorrhagic granulation tissue lining the surface of the ulcer was as a rule about 1 to 2 mm. in depth, except at the base, where a mass of finely granular and hemorrhagic connective tissue extended to the peritoneal coat. This point to the naked eye had a suspicious appearance of beginning carcinoma. The peritoneum of the lesser curvature extending over the tumor, contained a moderate amount of infiltrated fat adherent to the zone of inflammatory tissue about the ulcer. No lymph glands were to be made out in this infiltration. The remainder of the stomach excised and that left after excision was, after most careful inspection, found to be normal.

Microscopic Study.—Sections showed nothing but chronic inflammatory tissue. The surface of the ulcer has a narrow zone in which the connective tissue is very cellular and somewhat vascular. Beneath the mucous membrane surrounding the ulcer the connective tissue is very fibrous, infiltrating in all directions. The mucous membrane of the stomach ends abruptly. The only change to be noted is atrophy of the glands and slight lymphoid cell infiltration. There is no atypical growth of epithelium of the mucous membrane or its glands at the edge of the ulcer, and no hypertrophy of the glands beyond. The large lymph glands in the greater curvature show no evidence of metastasis, and but slight chronic inflammation.

This case is reported because of the difficulty in making a positive diagnosis at the exploratory operation, and to record in detail the naked-eye appearance with a hope that in the future similar cases can be recognized with some positiveness.

During the last year I have devoted considerable time to a study of the literature of diseases of the stomach, the most important of which are gastric ulcer and carcinoma. In International Clinics, Vol. I, for 1904, I have attempted to give a short résumé of this literature. The present almost unanimous opinion of surgeons favors exploratory operations in doubtful cases. Delay for a positive diagnosis between cancer and ulcer is not justifiable. There is little or no hope for a cancer of the stomach in the late period of the disease when the diagnosis is indicated by the examination of the gastric secretion. A tumor is a positive indication for operation; an absence of tumor is never a contraindication to operation. In young anæmic girls or in women exhibiting the typical clinical picture and gastric secretion of a simple ulcer an operation is only indicated when in addition there is hemorrhage or signs of gastric adhesions or pyloric obstruction, or in the event of failure of or only temporary relief from medical treatment. The so-called gastric neuroses, which as a rule are not difficult to differentiate from ulcer or cancer, should not be subjected to operation. If one takes this view, the diagnosis between ulcer and cancer cannot be made with certainty clinically. After the stomach is exposed, in a number of cases, the diagnosis of ulcer should not be difficult, and gastroenterostomy should be done. In other cases we can be quite certain that we are dealing with a carcinoma. If the operation is performed early, at least until our experience increases, I am inclined to think that there will be a large number of doubtful cases. These may be divided into two groups. In the first the indurated tumor is either freely movable or only slightly adherent. In this group complete resection should be performed. This operation gives the only hope for cancer, and as these patients are usually in good condition the mortality for gastrectomy, if it is an ulcer, should be but little if any greater than for gastroenterostomy. In the second group, the indurated tumor is so adherent to the surrounding structures that if the lesion were carcinoma it is past the hope of complete removal. For this reason gastroenterostomy should be performed. If the lesion is an ulcer, there will be permanent relief.

Future progress in surgery of the stomach depends upon the harmonious co-operation of the physician and surgeon. The problem of the physician is to secure a more positive differential diagnosis between ulcer and cancer in its earlier stages by the chemical study of gastric secretion. The problem for the surgeon is the differential diagnosis between ulcer and cancer at the exploratory operation.

DISCUSSION.

DR. HALSTED mentioned a case of carcinoma of the stomach which showed the difficulty of making a diagnosis. There had been a history of gastric ulcer extending over a period of three years. In this case a mass could be palpated before the operation through the abdominal parietes and enlarged glands could be detected along the duodenum and over the head of the pancreas. The distribution of the tissue was so different from what one would expect in a simple inflamed gland, he felt justified in making the operation. The report from the laboratory showed that it was a solid carcinoma. The patient recovered from the operation, has since gained about 30 pounds in weight, and his symptoms have disappeared.

Dr. Bloodgood.—I wish to ask Dr. Emerson if he has had early cases of cancer, cases proven at autopsy or operation to be cancer, in which hydrochloric acid was still present, where there would be a sufficient difference to aid one in making a diagnosis from ulcer? There must be such a stage in cancer. Is there anything in the chemistry of the subject at this stage that would help us in differentiating?

Dr. Emerson.—Cases of early cancer with abundant hydrochloric acid are not rare. One point in the early diagnosis of such cases is that if repeated examinations of the gastric juice be made the acid will be found very variable, or much more so than in simple ulcer, for early in the disease the amount found depends not only upon that secreted but also that neutralized by basic bodies furnished by, or at least depending upon, the presence of the cancer.

This variability in the amount of acid was present in Dr. Halsted's case, but enough examinations had not been made to demonstrate the point well.

Dr. Bloodgood.—That corresponds with the only two early cases that I know of in the literature that have been operated on and proven to be cancer. Where there was a very careful examination made every day for weeks, this change in the hydrochloric acid was noted. These are the only two cases, however, that I could find.

THE USE OF THE CYSTOSCOPE IN CASES OF PROSTATIC HYPERTROPHY.[1]

A Presentation of Charts to Facilitate the Interpretation of the Cystoscopic Views.

By Hugh H. Young, M. D.,

Associate Professor of Genito-Urinary Surgery, The Johns Hopkins University.

Since the beginning of cystoscopy it has been considered extremely difficult to determine with the cystoscope the exact size and contour of the intravesically hypertrophied prostatic lobes. Several cystoscopists have even asserted that it was impossible to arrive at an accurate idea of the conditions present. On the strength of these acknowledgments of failure, several surgeons have declared the cystoscope both useless and dangerous in cases of prostatic hypertrophy.

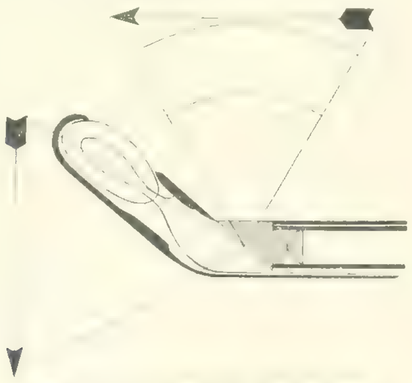

Fig. 1.—The simple Cystoscope.

Realizing the difficulties, but appreciating from numerous experiences the great advantage of the knowledge obtained by cystoscopic examination before operation in these cases, I set to work several years ago to devise a means of recording the views obtained with the cystoscope, so that we might formulate rules for their correct interpretation, and it is my purpose to-day to present the results of this study.

As shown in Fig. 1, in the plain cystoscope the rays of light are deflected 90° by the rectangular prism, and the line of vision is therefore at right angles to the shaft of the instrument. The base and lateral walls of the bladder, being more or less parallel to the shaft of the cystoscope, are easily viewed by the simple cystoscope. The anterior wall can be seen well only by considerably depressing the handle of the cystoscope, but in order to see the margins of the prostatic orifice it is necessary to withdraw the cystoscope until the prism enters the prostatic orifice (Fig. 8), when, for the first time, the margin comes into the field of view. But then, owing to the close proximity of the prism to the object viewed, there is considerable magnification produced. The picture thus obtained is as represented in Fig. 2, a segment constituting about one-sixth of the margin of the orifice. It is therefore necessary to take at least six consecutive views in order to see the entire circumference of the prostatic orifice. Owing to the spherical aberration, which is more or less pronounced near the periphery of the field of the cystoscope, it is better to take eight successive views.

We thus see that the study of normal orifice is beset with difficulties, but when we come to deal with the multitudinous forms of irregular and abnormal orifices produced by hypertrophied prostatic lobes, the chances of error, and difficulties of correct interpretation are greatly increased.

This led the writer to have constructed by Hirschmann in Berlin, in July, 1900, a cystoscope with which he could look almost directly backward so as to view the prostate orifice and its surrounding structures. This cystoscope differed greatly in construction from the cystoscope No. 3 of Nitze, which was intended to view the anterior wall of the bladder, and which I understand was never a mechanical success.

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[1] Presented to the American Association of Genito-Urinary Surgeons at Washington, D. C., June, 1903.

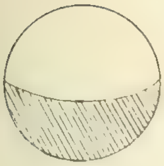


FIG. 2.

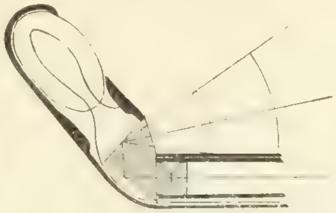


FIG. 3.

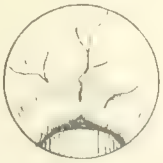


FIG. 4.

FIG. 2.—View of margin of prostatic orifice.
FIG. 3.—Author's prostatic Cystoscope.
FIG. 4. Field of view, prostatic Cystoscope.

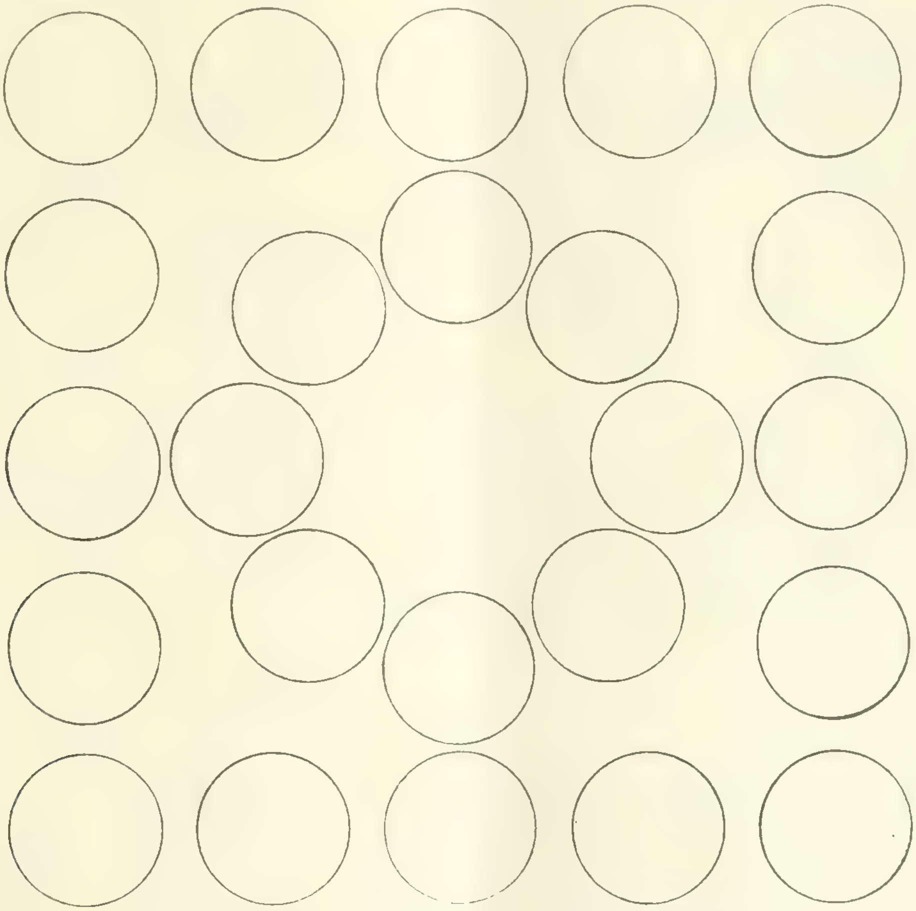


FIG. 7.—Chart for recording views of cystoscopy of prostate.

The design of my cystoscope is shown in Fig. 3. As seen here a prism with two reflecting surfaces was employed to enable the operator to see almost directly backward; the field of vision, as shown in Fig. 4, included the shaft of the instrument, one-half of the margin of the prostatic orifice and the adjacent vesical mucosa. It was thus possible with three or four successive views to examine the surface circumjacent to the prostatic orifice, and to see it without magnification, or aberration.

This instrument was demonstrated in 1900 to Professors Nitze and Casper in Berlin, and presented to the meeting of "the American Association of Genito-Urinary Surgeons," May 12, 1903.

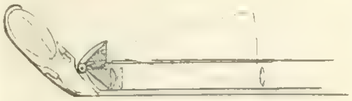


FIG. 5.

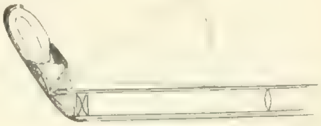


FIG. 6.

FIG. 5.—Schlagintweit's "Retrograd" Cystoscope.
FIG. 6.—Nitze's "Retrograd" Cystoscope.

Very soon after my publication there appeared in America the "Centralblatt für Harn und Sexual Organs," Heft. IV, 1903, containing a publication by Schlagintweit of his "Retrograd Kystoscop," in which he made use of a different system of prisms and lenses to accomplish the same object, as shown in Fig. 5.

About ten days later there appeared in America the "Monatsberichte für Urologie," Heft V, containing a publication by Schlagintweit of his "Retrograd Kystoscop," in which he made use of a different system of prisms and lenses to accomplish the same object, as shown in Fig. 5.

Nitze has since constructed a "retrograde" cystoscope, using two prisms with an intervening lens, as was done by

Schlagintweit, and only slightly changing the construction of the rest of the instrument (Fig. 6). But after using my own retrograde cystoscope, and later the subsequent models of Schlagintweit and Nitze, I have been forced to abandon all such instruments as entirely unsatisfactory.

This is due to several causes. In the first place, the optics of retrograde cystoscopy is necessarily much less perfect than that of the simple cystoscope. The rays of light must be reflected twice instead of once, losing thereby much light, reducing the size of the field and adding to the distortion and indistinctness of the object viewed.

In the second place, as it is possible to see at one time only a portion of the collarette of prostate surrounding the urethra, it is necessary to make at least four (and generally more) observations in the four cardinal directions to completely view the entire prostatic body, and as each field is inverted, the final interpretation is, in my experience, much more difficult than with the plain cystoscope.

But the most vital objection is that only a small portion of a large intravesical outgrowth can be seen at one time, and it is absolutely impossible to form any conception of the size of the entire mass. And then, since the simple cystoscope is necessary for a careful study of the bladder (I do not find Schlagintweit's satisfactory for this), the extra instrumentation involved in the use of a retrograde instrument is often a great drawback. After experience with my own retrograde cystoscope and an appreciation of the insuperable objections to it, I set about to find some rational means of facilitating the interpretation of the intravesical portion of the enlarged prostate with the simple cystoscope.

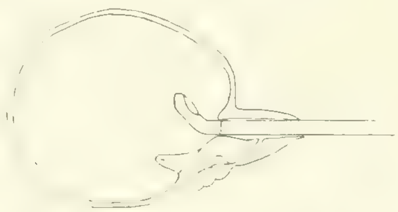


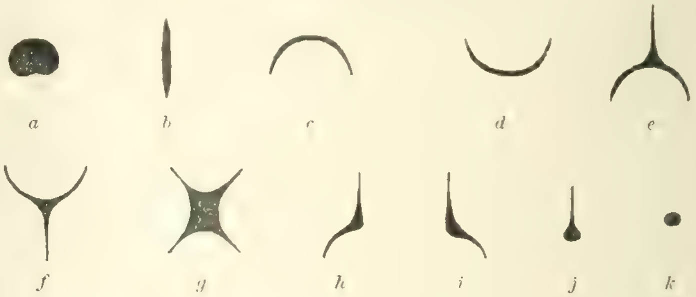
FIG. 8.—Position of cystoscope when viewing margin of prostatic orifice.

At first I began to record in circles the different views obtained in the four quadrants around the prostatic orifice. Finding four insufficient, I employed six circles, and then eight circles in which to draw the consecutive pictures. Later it was found advisable to have recorded additional views of the clefts, the relative position of the ureters, or the occasional presence of vesical tumors, calculi, diverticula, etc., so that finally a blank chart, of which Fig. 7 is a copy, was used as a routine in all cases. I have now thus preserved records of over 200 cases, and I wish here to outline the results obtained by a study of these cases, the cystoscopic interpretation of which have been confirmed by operation in many instances.

The Mechanics of Prostatic Obstruction.

Before discussing the cystoscopic findings it may not be amiss to consider the changes which occur at the prostatic orifice as a result of prostatic hypertrophy. I need hardly refer to the multiplicity of forms which prostatic enlargements may present. The prostate may be larger than an orange or not appreciably enlarged at all. It may present little or no change within the bladder, or it may almost fill the cavity. One or all of the respective portions of the prostate may be involved, thus presenting many varieties and forms.

As a rule, the median portion of the posterior commissure (the so-called median lobe), and the lateral lobes are the principal seats of change, but in rare instances the anterior commissure may furnish definite and even great enlargements. The shape of the prostatic orifice depends on the pressure which is brought to bear upon it by single or multiple enlargements of these various portions of the glands.



This is best shown diagrammatically. Thus, Fig. a represents the normal, almost round, prostatic orifice.

Fig. b, the orifice when the two lateral lobes are enlarged. As seen here it is flattened by lateral pressure, and appears as a vertical slit, the extremities or sulci of which are above and below.

Fig. c, the condition produced by the upward pressure of a median lobe hypertrophy. The orifice is an inverted crescent, and the floor of the urethra divided into two channels (Y-shaped). The sulci are obliquely downward and outward on each side.

Fig. d, the opposite effect of a single anterior lobe hypertrophy, the sulci being obliquely upward and outward on each side.

Fig. e, hypertrophy of the median and both lateral lobes. A sulcus above, and one obliquely downward and outward on each side.

Fig. f, the opposite of e, which is produced by an anterior and two lateral lobes.

Fig. g, enlargement of all the four cardinal portions of the prostate—an anterior lobe, two lateral lobes, and a median (posterior) lobe, with 4 sulci as a result.

Fig. h, the median and right lateral lobes confluent, that is, forming a single enlarged mass. Two sulci, one above, one below and to the left.

Fig. i, the opposite, the median lobe being confluent with the left lateral.

Fig. j, the median enlargement in the shape of a bar which is confluent, without intervening sulci, with an enlarged lateral lobe on each side.

Fig. k, an enlargement all around the orifice, leading to circular contracture without sulci.

The above figures cover (diagrammatically, of course) the great majority of the cases of prostatic hypertrophy. There are, of course, certain irregular and bizarre types which are not included, but which can be interpreted by a comparison with the foregoing.

Cystoscopic Pictures of the Various Forms of Hypertrophy.

(a) *The Normal Prostate.*—As remarked above, with the simple cystoscope of Nitze (Fig. 1) the operator sees in a direction at right angles to the shaft of the instrument or the urethra. As seen in Fig. 8, an object such as the prostate which surrounds the shaft of the cystoscope can only be seen when the prism is drawn out close to it, and the image is inverted and magnified. Furthermore, only a small segment of the encircling mass can be seen at a time, so that it is necessary to take at least six separate and successive views in different directions to complete the circumference and see the entire object.

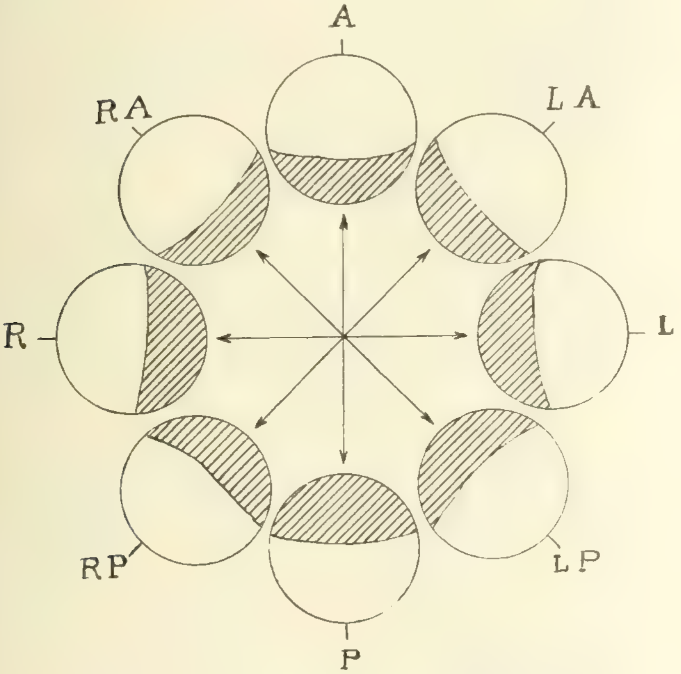


Fig. a′.—Views of the normal prostatic orifice.

The appearance of one such segment (*e. g.*, the anterior) is shown in Fig. 2, the concave line representing the curved segment of the prostatic orifice, the shaded portion of the urethra adjacent to the orifice and the unshaded portion the vesical cavity.

In order to record the entire circumference of the prostatic orifice, it is necessary to have several such circles (preferably 8), and they can be best arranged around a common focal point as shown in Fig. a′. The direction of the circle chosen for record from the central point should correspond to the direction of the beak of the cystoscope. Beginning at one of the cardinal points we are thus able to record the views obtained at intervals of 45° around the entire orifice.

Beginning with A, the beak of the cystoscope is directed upward so as to view the anterior segment of the prostatic orifice. It is then turned 45° to the right and the result recorded in RA. Then 45° further to the right, until the beak is now directed directly to the right lateral lobe, and the picture recorded in R. The process is thus continued, the cystoscope being rotated 45° each time, and the direction of the beak being indicated on the circle which corresponds to that direction, until the entire circumference of the orifice has been viewed and its contour recorded in the series of circles. The record shown in Fig. a′ is taken from a normal prostatic orifice. The resulting pictures, therefore, represent the following segments of the prostatic orifice:

A, the anterior.
RA, the right antero-lateral.
R, the right lateral.
RP, the right postero-lateral.

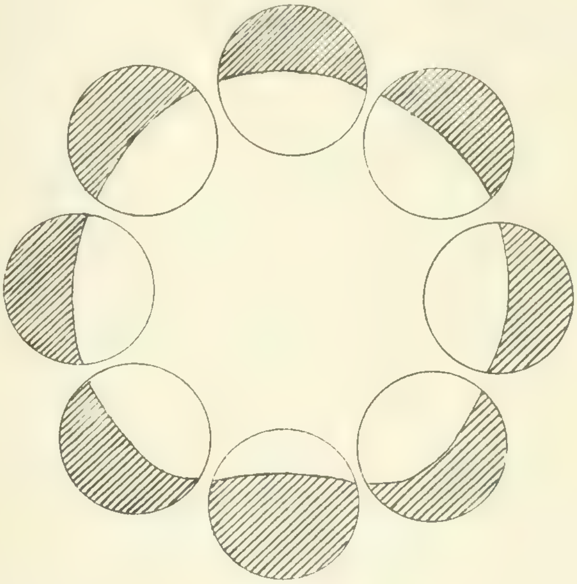


Fig. a″.—The same, inverted, showing outline of magnified normal orifice.

P, the posterior (or middle lobe).
LP, the left postero-lateral.
L, the left lateral.
LA, the left antero-lateral.

As stated above, each of these pictures is an inverted image. If we invert each of the recorded circles, as shown in Fig. a″, we obtain the circular prostatic orifice (magnified, of course).

(b) *The Bilaterally Hypertrophied Prostate.*—As remarked above, the urethra in these cases is compressed by two lateral enlargements and transformed into a vertical slit with a sulcus above and a sulcus below. Between these on each side are more or less rounded lateral lobes. The cystoscopic pictures obtained in such a case (I have selected one in which the exact nature of the enlargement was confirmed at operation) is shown in Fig. b′. (The shape of the orifice as shown in Fig. b above is reproduced in the center. This will also be done in subsequent illustrations.)

We see here a deep sulcus above and below (A and P), while the lateral views show on each side the rounded contour of the lateral enlargement projecting into the bladder. If each of these pictures be inverted, we will have a magnified picture of a prostatic orifice in the shape of a vertical slit with an hypertrophied lateral lobe on each side, as in Fig. b″.[2]

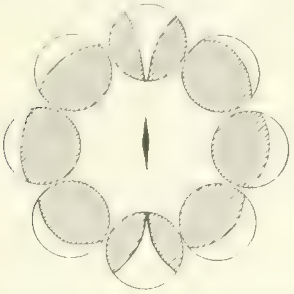


Fig. b′.—Hypertrophy of the two lateral lobes.

Fig. b″.

(c) *Small Median Lobe Hypertrophy, with no Enlargement of the Lateral Lobes.*—As seen in Fig. c (reproduced in the center of Fig. c′), the urethral orifice is in the shape of an inverted crescent with sulci on each side of the median lobe. The cystoscopic pictures obtained here as shown in Fig. c′. As seen here there is no change from the normal when looking upward (A) or to either side (R, RA, L and LA), but the three inferior views are greatly changed, P showing a rounded intravesical outgrowth, and RP and LP the sulci which lie on each side of it (the ends of the crescent). Sometimes the median lobe is so small that it is greatly depressed by the cystoscope (which lies against its anterior surface) and the sulci are then seen in R and L as shown in Fig. c″.

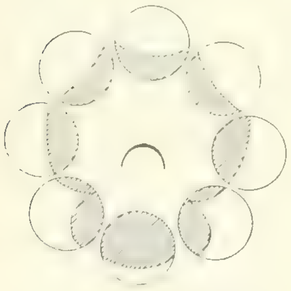


Fig. c′.—Small median lobe.

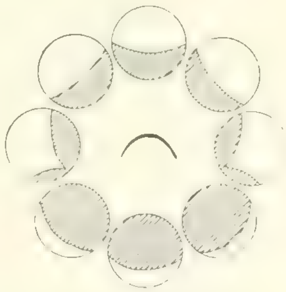


Fig. c″.—Median lobe.

Care must be taken not to be deceived as to the size of the lobe. Owing to the immediate juxtaposition of the prism of the cystoscope, such a lobe is always greatly magnified, and the fact that it is seen in 5 fields (R, RP, P, LP and L) should not be taken to mean that it is always large. I have frequently been greatly mistaken as to the size of a middle lobe. By elevating the inner end of the cystoscope, the lobe may often be viewed from a better distance and great magnification avoided. I have numerous records showing Figures c′ and c″.

(d) *Anterior Lobe Hypertrophy.*—The cystoscopic pictures obtained in such a case are shown in Fig. d′. As there is no lateral or median posterior lobe enlargement, the fields corresponding to these are normal (R, RP, P, LP and P), but the three anterior pictures show the changes which correspond to the crescent-shaped orifice (Fig. d), *viz.:* a rounded, bulging mass in A, and a sulcus to each side of it, in RA and LA.

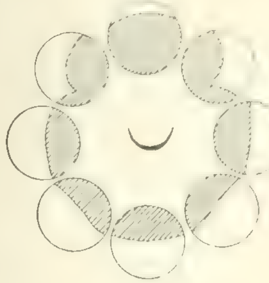


Fig. d′.—Anterior lobe.

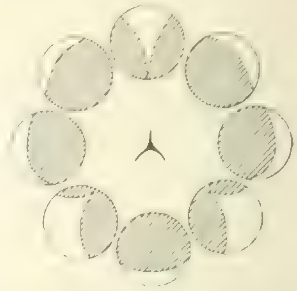


Fig. e′.—Median and bilateral lobes.

(e) *Median and Both Lateral Lobes Enlarged.*—The orifice in this case is in the shape of an inverted Y (Fig. e) (which is a combination of b and c). The cystoscopic pictures obtained are (as might be expected) a combination of those seen in Figs. b′ and c′, and are shown in Fig. e′. The sulci are seen in A, RP and LP. The median lobe is shown in P and portions of RP and LP, the right lateral lobe in RP, R, RA and the right half of A, and the left lateral lobe in LP, L, LA and the left half of A. If we imagine each of these pictures inverted, we will see at once that we have two lateral lobes separated by an anterior sulcus, and a median lobe separated from each lateral lobe by a sulcus. (As mentioned in (c) the sulci on each side of the median lobe may be seen in R and L.)

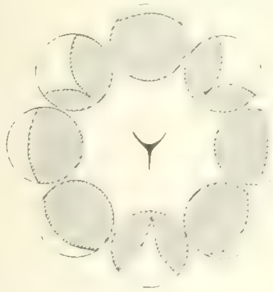


Fig. f′.—Anterior and bilateral lobes.

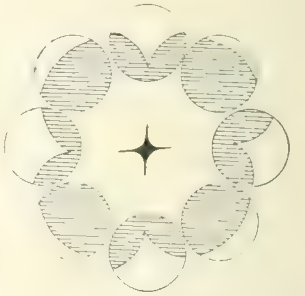


Fig. g′.—Anterior, median and both lateral.

(f) *An Anterior and Two Lateral Lobes.*—The orifice here is a Y, the opposite of (e). The pictures obtained are also the opposite, the clefts appearing in P, RA and LA, and the three lobes in the intervening fields.

(g) *Both Lateral, Median and Anterior Lobe Hypertrophy.*—As stated before, the urethra is here compressed from all four directions and the shape of the orifice is shown in the center of Fig. g′. The pictures obtained in such a case are seen in Fig. g′, the clefts appearing in RA, LA, LP and RP, and the intervening lobes in A, L, P and R.

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[2] This inversion will not give an exactly accurate picture of how the prostatic hypertrophy really looks for several reasons; *viz.:* There is always a certain amount of distortion toward the periphery of every field of the cystoscope, and on that account I have taken eight circles instead of six (which is really all that should be necessary were there no aberration of the image). As a result, these fields overlap. Another reason is that we do not look directly at the orifice, but at right angles to it, and we cannot expect the composite picture to exactly represent the orifice, when viewed from behind.

(h) *Median Lobe Confluent with Left Lateral Lobe.*—In such cases the three lobes are each enlarged, but there is no intervening sulcus between the median and right lateral lobes, the two lobes forming one mass. The orifice is shown in Fig. h′ (for convenience shown as if viewed from without), the clefts appearing in A and RP. LP shows a confluence of the median and the left lateral lobes without any intervening cleft.

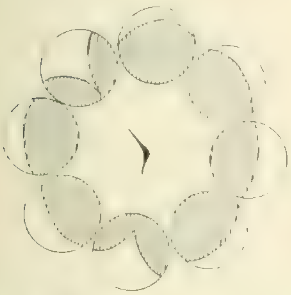

Fig. h′.—Median and left lateral confluent.

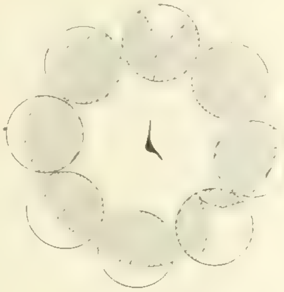

Fig. i′.—Median and right lateral confluent.

(i) *Median Lobe Confluent with Right Lateral Lobe.*—As shown in Fig. i′, the pictures obtained are the counterpart of h′.

(j) *Median Bar Confluent with Both Lateral Lobes.*—In such a case we have only one cleft and that in A, the median bar being continuous with the lateral lobes without intervening clefts, as shown in Fig. j′.

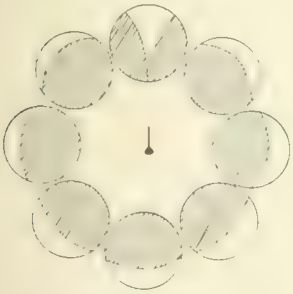

Fig. j′.—Median confluent with both lateral lobes.

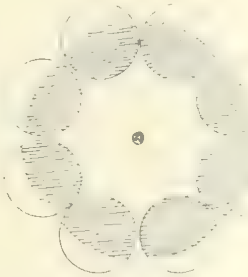

Fig. k′.—Collarette without clefts.

(k) *The Collarette. All portions being enlarged and continuous without intervening clefts.*—In these cases the prostate projects into the bladder in the shape of a collar, the median bar and the lateral lobes all being continuous with each other without definite intervening sulci. In such cases the cystoscopic pictures show a continuous enlargement all round the prostatic orifice, as shown in Fig. k′. The extent of the enlargement cannot be shown in the pictures, which do not appear to differ greatly from those of the normal, but this must be determined by the relations of adjacent parts (ureters, bladder wall, etc.).

(l) *Large Median Lobes.*—In Fig. c we saw the inverted crescent shaped orifice produced by a median lobe. If the urethra in such a case be opened anteriorly, we find it divided at a point in front of the median lobe into two ditches, one of which passes on each side of the median lobe—the Y-shaped urethra of Thompson. If the lobe is small, or if it springs from a base well in the bladder (an hypertrophy of the subcervical group of glands beneath the anterior portion of the trigone), the orifice may be very little enlarged, and the shaft of the cystoscope will be found in the median line resting against the anterior surface and summit of the lobe. The cystoscopic pictures in such a case were given in Fig. c′.

If, however, the orifice of the urethra is widely separated by a prominent, anteriorly directed median lobe, the cystoscope will generally pass into the bladder along one of the branches of the Y and the shaft will be found to occupy "by choice" the sulcus to one side of the lobe, as shown in Fig. 9.

It is an easy matter, as a rule, to carry the cystoscope into the other sulcus by successively depressing the outer end of the instrument, pushing it in the opposite direction, and then elevating it. This manœuvre will generally cause the vesical end of the cystoscope to traverse the front of the middle lobe from one sulcus to the other. If the middle lobe is quite high it is advisable to hug the anterior vesical wall with the beak of the cystoscope rotating the shaft, as the manœuvre described above proceeds, so as to keep the beak continually directed away from the middle lobe.

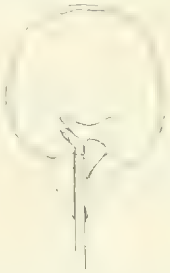

Fig. 9.—A position "of choice" in large middle lobe hypertrophy. Cystoscope in one of the sulci.

These manœuvres were made use of by the writer in performing the Bottini operation in middle lobe cases, and were fully described in "Monatsberichte für Urologie," January, 1901. The cautery incisions were by this technique directed across the base of the middle lobe, thus dividing the greater part of its blood supply and leading to atrophy.

If in a case of marked median lobe hypertrophy the cystoscope lies in the sulcus to the right of the lobe, we will see, when looking to the left, not the left lateral lobe, but the right side of the median lobe. The cystoscopic pictures taken from this position are shown in Fig. l′. These were taken from a case with large median lobe hypertrophy. As seen here R, RA and RP show that the right lateral lobe is not at all intravesically enlarged. There is no sulcus or cleft shown in RP, because the cystoscope lies at the bottom of the cleft flattening it out so that we see only the mucous membrane connecting the two lobes. In P we begin to see the base of the median lobe, and rotating the instrument further to the left we see the increasing prominence of the median lobe in LP and L. In LA its summit appears and in A we see the cleft which separates it from the anterior border of the prostatic orifice. We notice here also that the mucous membrane is not continuous from one to the other, as is the case with sulci which separate the median lobe from the two lateral lobes posteriorly as seen in Fig. c′, because the middle lobe is necessarily separated from the anterior border of the prostatic orifice by the urethra.

After preparing the above set of pictures we placed the cystoscope in the bottom of the sulcus to the left side of the middle lobe by the manœuvre described above (*viz.:* beak to right, (R) cystoscope drawn out till beak hugged right lateral edge of the prostatic orifice, handle of the instrument depressed, and carried slowly to the right, beak at same time being rotated through RA, A, LA, L. Handle elevated when the beak reached LP, thus placing the instrument in the left sulcus, having traversed the crescent in front of the middle lobe).

The pictures obtained from this position are shown in Fig. l″. We see at once that they are the counterpart of those of l′, taken from the opposite sulcus. The left lateral lobe (shown in L and LA) is seen to be a little larger than the right lateral, and the bottom of the sulcus (LP) is not absolutely obliterated. The non-continuity of the median lobe and the anterior portion of the prostatic orifice is shown in A. The median lobe is shown to be more rounded and prominent on this side (P, RP, R, RA and A).[3]

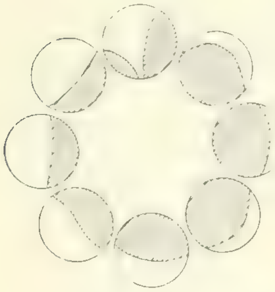

Fig. l′.

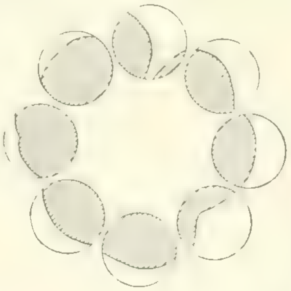

Fig. l″.

Fig. l‴.

Fig. l′.—Large median lobe. Pictures from right sulcus.

Fig. l″.—Large median. Pictures from left sulcus.

Fig. l‴.—Normal anterior segment of urethral orifice behind middle lobe.

In some instances picture A does not show a cleft absolutely open, but thus, Fig. l‴. Further examination will show, however, that the left side of the cleft is at a higher (or more distant) level and by elevating the cystoscope it is possible to follow this border of the prostatic orifice until the middle lobe disappears from view (the cystoscopic shaft intervening). By continuing the process (rotating the shaft, etc., in reverse order of the manœuvre described before), the instrument will be carried across into the other sulcus and to the right of the lobe.

In many cases it is possible to get three sets of pictures from a middle lobe case. One from the top of the middle lobe, as in Fig. c′, and one from each lateral sulcus, as in Figs. l′ and l″.

Changes in size and shape vary with the position of the cystoscope.—In a normal case, if the handle of the cystoscope is greatly depressed with the beak looking downward, the interureteral bar may appear almost on a line with the edge of the median portion of the prostate, as shown in 1, Fig. m. If the handle be gradually elevated, the distance between the two will be correspondingly increased, as shown in 1, 2, 3, 4 (the latter being the position in which the handle is elevated above the horizontal).

In the same way the ureteral orifices may be made to disappear behind the prostatic orifice by depression of the handle of the cystoscope, as in 1, Fig. n, in which the beak is directed toward the right ureter. By elevating the handle the distance between the two is progressively increased as shown in 2, 3 and 4.

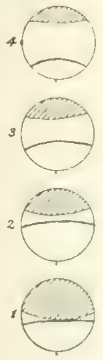

Fig. m.

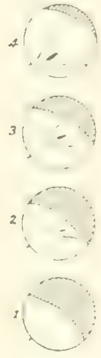

Fig. n.

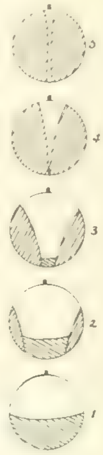

Fig. o.

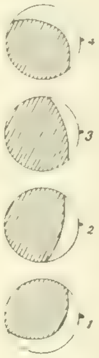

Fig. p.

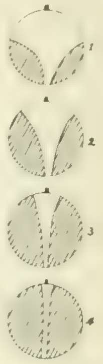

Fig. q.

Fig. m.—Changes in distance between median bar and interureteral bar by elevating handle of cystoscope.

Fig. n.—Ditto for ureteral orifice.

Fig. o.—Different views of an anterior cleft as seen by progressively elevating handle of cystoscope.

Fig. p.—Large left lateral lobe as seen by elevating handle.

Fig. q.—Views obtained by simply drawing cystoscope out.

Fig. 10.—Showing difficulty of seeing ureters and interureteral bar when an enlarged median bar is present.

Such a series of observations is often of great value in determining the height of a median bar. If you are unable, as shown in Fig. 10, even with considerable elevation of the handle of the cystoscope, to see the ureteral orifices or the ligamentum interutericum, you know at once that the ureters lie beneath a fairly large median bar. If, however, they can be brought into plain view, well above the prostatic median portion, the median bar is slight. The same rule holds good for median lobes, when the cystoscope remains on top of the enlargement. If the shaft of the instrument slips to one side of the lobe (into one of the sulci), the orifices are often brought clearly into view, although the lobe is large.

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[3] The cystoscopic diagnosis was confirmed in this case by the suprapubic removal of a moderately large median lobe.

Likewise the picture presented by a cleft between two lobes varies greatly according to the position of the cystoscope, as shown in Fig. o, in which the beak is directed upward between two enlarged lateral lobes. When the handle of the instrument is greatly depressed, the inner end of the shaft is pressed up into the upper limit of the sulcus, the lobes are widely separated and the cleft is flattened out. The prism of the instrument then shows only the tautly-stretched transverse fold of mucous membrane which runs across from one lobe to the other, as seen in 1. As the handle of the cystoscope is gradually elevated the prismatic end descends, and the lateral lobes begin to appear on each side (2 and 3), the transverse fold of mucous membrane disappears from view (4), and finally we see only the narrow chink which separates the closely approximated lobes (5).

This series of pictures is of great value in showing the extent of the hypertrophy, and the depth of the ureteral cleft. In the case from which these pictures were copied the lateral lobes were very large and extended far into the bladder (as shown by prostatectomy). In other cases where the lateral lobes are less prominent the cleft is shallower and does not appear as the narrow chink shown above in 5.

If, while the prism of the cystoscope is directed toward one of the enlarged lateral lobes, the shaft be raised or lowered, different portions of the lobe will be seen and the picture correspondingly changed, as shown in Fig. p (taken from the case referred to above). Here the beak is directed toward the left lateral lobe. In picture 1 the handle is much depressed and we see the upper or anterior curved border of the lobe, in 2 and 3 it has been gradually elevated and the middle portion is shown, in 4 the handle is greatly elevated and we see the lower edge of the intravesical projection of the lobe. In this series of pictures we have transversed the entire intravesical curvature of the lobe parallel to the plane of the urethra.

If again, while holding the shaft and beak in a relatively fixed position, the instrument be gradually drawn outward, the pictures progressively change in certain cases, *e. g.*, with the beak looking up between the enlarged lateral lobes at a point where their intravesical summits approach each other, the picture obtained is shown in 1, Fig. q. The instrument was then gradually drawn out, without elevating or depressing the shaft, and the pictures shown in 2, 3 and 4 obtained, which, interpreted, simply means the lobes approach closer and closer to each other as you come outward.

Remark.—I have given thus in detail the multitudinous changes of view which may be obtained in certain cases of hypertrophied prostate in the hope that many of the pictures which seem hopelessly inexplicable may be brought to a simple interpretation by due consideration of the laws governing the cystoscopy of the prostate. I will now give a few illustrated cases, in which it will be noticed that I have made routine use of a square of circles surrounding the ordinary circular prostatic set. I have found these very valuable in recording not only the changes of view brought about by change of position of the cystoscope, but also the presence of other interesting concomitants; diverticula, tumors, stones; changes in the ureteral orifices, in fact anything which may be pictorially recorded. The point indicates always the direction of the beak of the cystoscope, and where a series is taken with the beak in one direction, the lowest picture corresponds to the lowest position of the handle; the farthest to the right or left the corresponding direction of the handle, and *vice versa.*

CASE I. *Chronic prostatitis, with slight thickening of median portion of prostate. Prostatic massage. Cure.*

K., aged 72, male, complained of great frequency of urination of several years' duration. Examination showed that the prostate by rectum was indurated, but little enlarged, and that the seminal vesicles were indurated. The secretion obtained by massage of the prostate showed many pus cells. There was no stricture present, the catheter passed easily, and there was no residual urine found. The cystoscopic pictures of the prostatic orifice are shown in Fig. 11. There was a slight increase in thickness in the median portion of the prostate (P and LP), but the ureters were easily seen. With the beak looking downward (series D), when the handle was greatly depressed the interureteral bar was not visible, but by elevating the shaft it came into view (2) and continuing the process still more of the trigone was visible (3 and 4), but the more rounded contour of the posterior surface of the small median bar was seen (4).

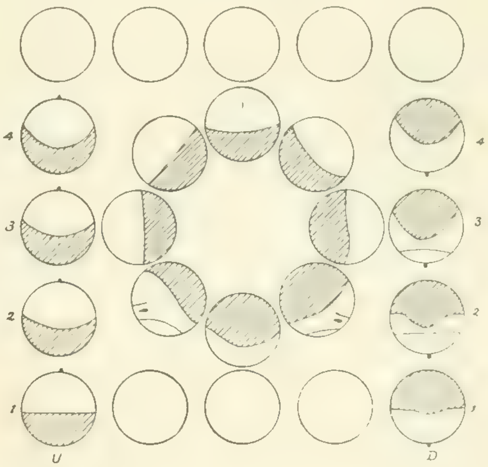

FIG. 11.—Case I. Slight enlargement median portion.

With the beak looking upward (series U), the absence of a cleft, when the handle of the cystoscope was gradually elevated, showed that no lateral enlargement was present. (2 and 3). The diagnosis of chronic prostatitis, with slight thickening of median portion of prostate was made, and its correctness verified by cure of the case with prostatic massage.

CASE II. *Enlargement of both lateral lobes, with small posterior fold joining them. Prostatectomy. Cure.*

J. T. Y., aged 60, male, admitted with a suprapubic fistula, the result of an operation six months ago. On rectal examination, both lateral lobes of the prostate were considerably enlarged, and between them at the upper end, the notch was wide and deep. The cystoscope showed considerable enlargement of both lateral lobes which were separated by a deep cleft in front (A and series U), but were joined by a transverse fold of mucous membrane posteriorly. Looking downward (series D), with the handle depressed, the two lateral lobes came together leaving only cleft enough to see the tranverse fold in the median portion (1). On elevating the handle the lobes were pushed aside and only median fold was seen. With the finger in the rectum and the cystoscope in the urethra the median portion of the prostate showed no increase in thickness. The diagnosis of an intravesical hypertrophy of only the two lateral lobes was made. Another cystoscope inserted into the suprapubic sinus, showed exactly what had been predicted—two enlarged lateral lobes and between them the urethra compressed into a vertical slit (X), and a transverse fold joining the lobes posteriorly in the median portion of the prostate (Y). The other cystoscope in the urethra was seen to lie at the bottom of the cleft (Z).

Nitze's new retrograde cystoscope was then introduced through the urethra and an attempt was made to map out the prostatic enlargements. The vertical slit of the urethra between two lateral lobes was seen when the beak was directed anteriorly. But on looking outward and downward it was absolutely impossible to get any idea as to the size and shape of the lateral lobes. Later the two lateral enlargements were removed by the perineal route, and the absence of median hypertrophy confirmed. The urethra and ejaculatory ducts were preserved, and the patient has had an excellent result.

The necessity of series D is shown in this case, for without it we would have failed to find the posterior cleft, which was not shown in the ordinary "prostatic set" as seen above, P showing a transverse straight line (the transverse fold joining the two lobes). As seen with the second cystoscope in Z, the instrument lay at the bottom of the cleft against the transverse fold, separating widely the lateral lobes.

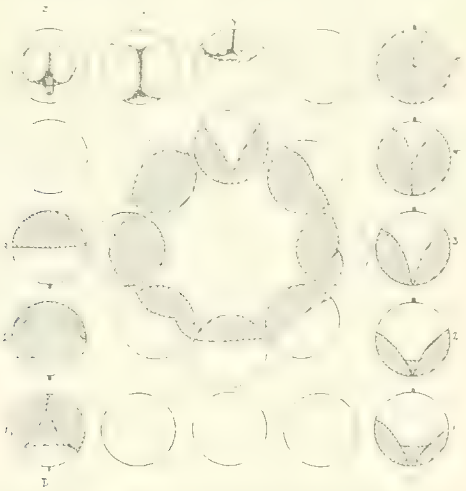

FIG. 12.—Case II. Moderate bilateral hypertrophy.

CASE III. *Great intravesical enlargement of both lateral lobes. Prostatectomy. Cure.*

W. F. S., male, aged 55 years, leading catheter life. Prostate by rectum greatly enlarged. The cystoscope showed a very great intravesical enlargement of each lateral lobe, the urethra being transformed into a very deep vesical slit, as shown by the deep clefts in A and P. The great depth of those clefts is shown in both U and D. In No. 1, of series U, the handle greatly depressed and we see the curved anterior margin of urethra, the cleft having been flattened out, but in 2 when the handle was slightly elevated the sides of the lateral lobes appear, and as we elevate the handle more and more only a narrow chink remained between. Similar pictures were obtained by looking downward (D): in 1, (the handle being depressed), a median joining fold is seen, but this rapidly disappeared as we elevated the cystoscope.

The median fold was differentiated from a bar also by the fact that the ureters and trigone were plainly visible (X and Y), and because with the finger in the rectum no increase in the median portion of the prostate could be felt between it and the cystoscope.

The patient came to operation—perineal prostatectomy. Both lateral lobes were very large, but there was no enlargement of the median portion. The urethra and ejaculatory ducts were preserved, and the patient now reports sexual powers normal.

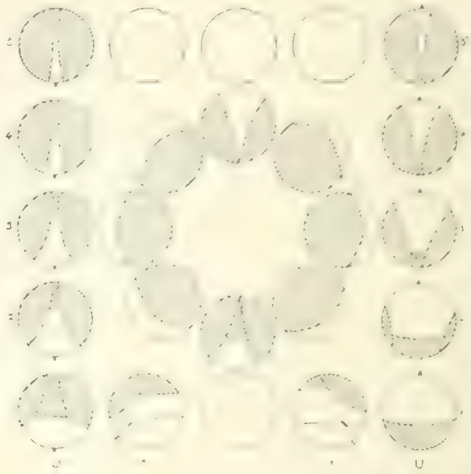

FIG. 13.—Case III. Large bilateral hypertrophy.

CASE IV. *Slight prostatic hypertrophy without clefts. Bottini operation. Result shown cystoscopically.*

S. M. J., aged 64 years. Complaint, frequency and difficulty of urination. Onset six months ago with pain.

Examination.—Prostate moderately hypertrophied and slightly indurated. Prostatic secretion contain pus cells. Very little residual urine. Bladder capacity 150 cc.

Cystoscopic examination.—There is a slight enlargement of the lateral lobes and of the median portion of the prostate, but as seen in the pictures (Fig. 14) there are no marked intervening sulci, neither at A between the lateral lobes, nor between and the median in RP or LP. The median bar is therefore continuous with the lateral lobes, but it is slight and the ureteral ridges can be easily seen and are irregularly hypertrophied. Behind the interureteral ridge is a small calculus (see lower circles).

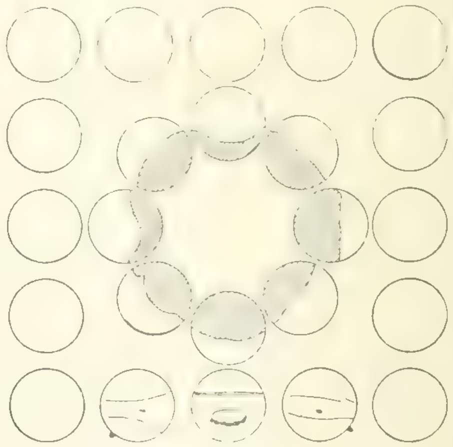

FIG. 14.—Case IV. Slight hypertrophy, median bar and collarette.

Operation.—Lithotomy. Bottini operation with blade No. 2 (1.2 cm. high) of my instrument; three cuts, one median posterior, one right lateral, one left lateral Result excellent.

Cystoscopy 15 days after operation.—Three sloughs have passed and the lateral cautery incisions are seen in **Fig. 15, R** and L, both showing considerable depth and width. The median cut as shown in P is deep, but the edges are closely approximated. There is considerable inflammatory swelling of the mucous membrane of the entire orifice, as seen in all the pictures. In series A No. 1, the handle is pushed far to the right and prism lies in the bottom of the left lateral cut, the ragged edge of which is seen. By carrying the handle to the left the edges of the cut appear in 2, are still closer together in 3, and finally in 4, in which the handle is pushed far to the left, the edges of the cut are seen closely approximated. The same changes, when viewing the other lateral cut from different positions of the prism, are shown in series B. Again in No. 1, the shaft is pushed well into the bottom of the cut, and in the others it is gradually carried away from it allowing the sides to come together. The different views of a cut obtainable by simply drawing the cystoscope out are shown in series C. In 1, the prism is on a level with the orifice and lies in the depth of the cut. It is then gradually drawn out, and in 5 when the prism has been drawn far into the urethra only the sides and bottom of the cleft are seen.

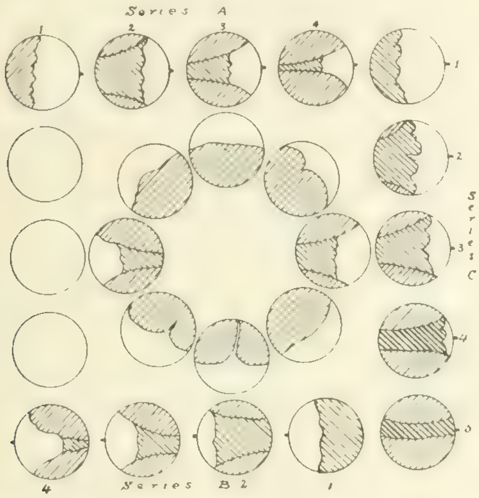

FIG. 15.—Case IV. After Bottini operation.

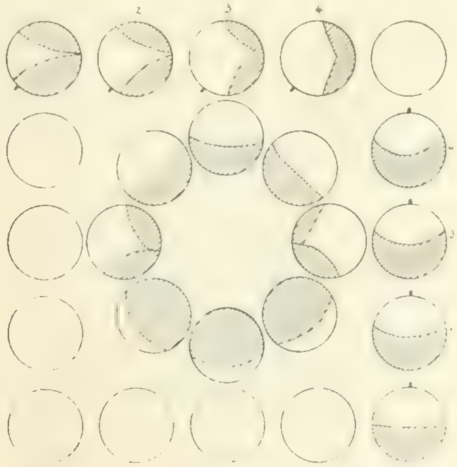

FIG. 16. Case V. Cystoscope on summit of median lobe.

These pictures were recorded merely to show how necessary it is to have successive views, especially of clefts, in order to estimate their depth and extent, and to avoid mistakes. If only the No. 1, of the three series had been taken, we would have failed to recognize that a cleft was present.

CASE V. *Small pedunculated median lobe, no lateral enlargement. Perineal prostatectomy. Cure.*

J. R., aged 70, complained of great frequency of urination. The prostate by rectum appeared very little enlarged. Residual urine 460 cc. The cystoscope showed very little intravesical enlargement of the lateral lobes, but a moderately enlarged almost pedunculated median lobe, as shown in the cystoscopic pictures. With the handle of the instrument somewhat depressed the pictures shown in Fig. 16 were obtained. In this the median lobe is shown in P, RP, and LP, and deep clefts on each side in R and L. Series U with the beak looking upward, the handle being gradually elevated, shows absence of the anterior cleft, which is present if the lateral lobes are hypertrophied. The series of pictures in the top row of circles show the extreme depth of the right cleft in (1), and how it was gradually flattened out by carrying the shaft of the cystoscope into it (2, 3 and 4).

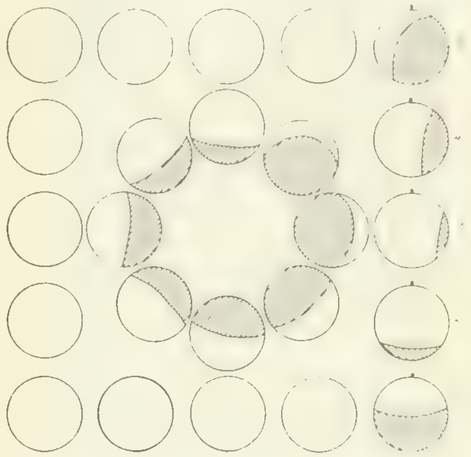

FIG. 17.—Case V. Cystoscope in sulcus to the right of median lobe.

Fig. 17 shows the pictures obtained with the cystoscope in the sulcus to the right of the median lobe, which therefore appears in L and LA, and the absence of the clefts seen in Fig. 16 in LP and RP. The median lobe does not appear in A, the anterior segment of the urethra alone being seen. By gradually pushing the cystoscope further in as in series U, this anterior segment disappears (after 2) and the side of the middle lobe appears (in 3), and gradually becomes more prominent (4 and 5).

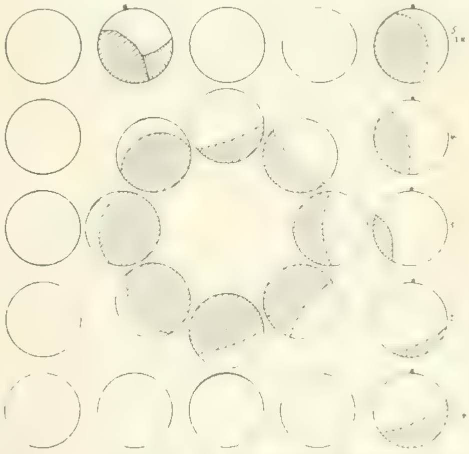

FIG. 18. Case V. Cystoscope in the sulcus to the left of the median lobe.

Fig. 18 shows the views obtained with the cystoscope in the sulcus to the left of the middle lobe. They are seen to be the counterpart of those shown in Fig. 17. In one of the upper line of circles is depicted the summit of the middle lobe obscuring a portion of the anterior segment of the prostatic orifice.

At operation I removed by the perineal route, a small left lateral, a smaller right lateral, and a pedunculated median lobe about 2 cm. in diameter and 3 cm. long, as shown in the accompanying photograph (Fig. 19). The median lobe was enucleated through the left lateral cavity. The prostatic urethra, the ejaculatory ducts, and the bladder were not torn.

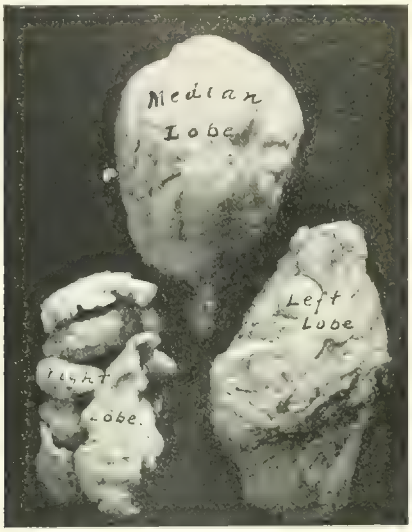

FIG. 19.—Small lateral lobes and pedunculated middle lobe.

This case illustrates well the great magnification of the median lobe obtained in such cases. Had the cystoscope passed first into one of the sulci, one might have easily mistaken the median lobe for an enlarged lateral lobe. However, the series of pictures obtained by drawing the cystoscope outward while looking steadily upward would have shown at once the lack of continuity of the two lobes. The pictures from other positions (*viz.*, on the top of the middle lobe, Fig. 16), demonstrate clearly the origin of the enlarged lobe.

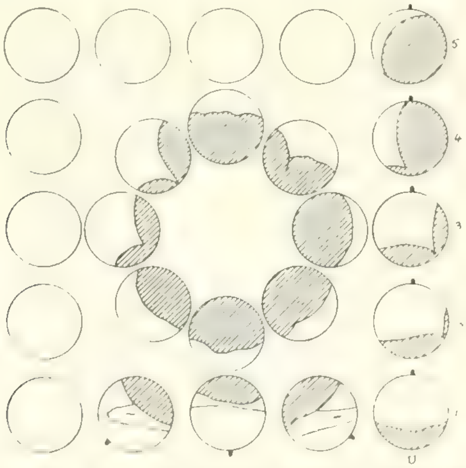

FIG. 20.—Case VI. Large left lateral confluent with median bar and anterior lobe.

CASE VI. *Anterior lobe and median bar confluent with large left lateral lobe hypertrophy. Comparatively small right lateral lobe. Perineal prostatectomy.*

S. T. A., aged 70, complained of having had to use catheter for eight years. Rectal examination showed a very considerable enlargement of the prostate. The cystoscopic pictures obtained are shown in Fig. 20. As seen here we found very little intravesical enlargement of the right lateral lobe, a broad median bar confluent with a large left lateral lobe (no cleft between in LP), and an anterior lobe (A) with sulci in RA and LA. The cleft in RA was much deeper, and the pictures obtained by placing the cystoscope into the depths of it (1), and then gradually elevating the handle, are shown in series U. They resemble those obtained in a case in which a median lobe (posterior) is present, but differ in the important fact that the two lobes are continuous, which is not the case of the median lobe, as remarked above in case V.

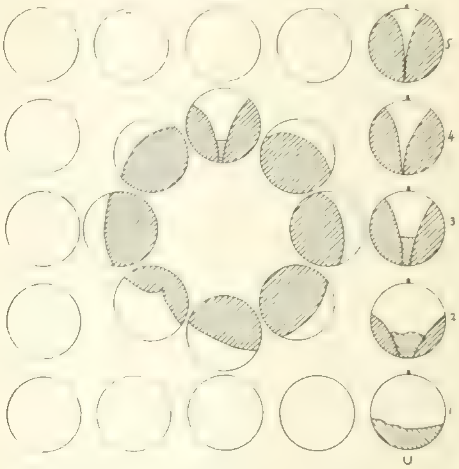

FIG. 21.—Case VII. Bilateral and median bar confluent.

Perineal prostatectomy was performed. The right lobe was moderately enlarged weighing g. 28. The median bar, left lateral and anterior lobes were enucleated in one mass which weighed g. 61. The urethra and ejaculatory ducts were preserved. The patient left hospital well.

CASE VII. *Median and bilateral hypertrophy. Prostatectomy. Subsequent cystoscopy.*

W. S. O., aged 58, complained of catheter life. Prostate by rectum moderately enlarged. The cystoscope (see pictures Fig. 21), showed a moderate intravesical hypertrophy of both lateral lobes, and a fairly large median bar which was confluent with the left lateral lobe, but was only separated from the right by a shallow sulcus. The anterior series of pictures (U) showed considerable compression between the lateral lobes when the handle was elevated. The right ureter could be seen behind the bar, but the left could not.

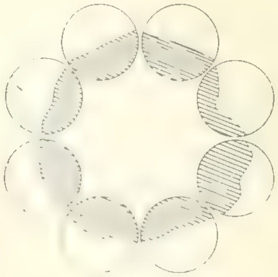

FIG. 22.—Case VIII. After prostatectomy.

Perineal prostatectomy was performed. The lateral lobes were moderately large, and the median bar was easily enucleated

through the cavity remaining after removal of the left lateral lobe. The urethra and ejaculatory ducts were not disturbed. Cystoscopy performed 10 months after the operation showed an irregular outline, consisting of folds of mucous membrane, but no prostatic hypertrophy as shown in the pictures, Fig. 22. The ureters were easily seen. There is no residual urine present and the patient is cured.

I wish to thank Dr. Halsted and his associates for many courtesies extended.

THE CLINICAL EFFECTS OF SURGICAL ANÆSTHESIA AND OPERATIONS UPON ANÆMIC PATIENTS.

WITH A REPORT OF CASES FROM THE GYNECOLOGICAL CLINIC OF THE JOHNS HOPKINS HOSPITAL.

By Henry T. Hutchins, M. D.,

Medical House Officer, The Johns Hopkins Hospital, Baltimore, Md.

Many surgeons regard operations and the giving of a general anæsthetic as contraindicated when the hæmoglobin in the blood is below a certain per cent. Different standards have been adopted by different men. Thus von Mikulicz chooses 30 per cent as his standard; Hamilton Fish advises 50 per cent, and Da Costa and Kalteyer, in a recent article, advocate 40 per cent. These standards have been adopted chiefly as the result of examinations of the blood made during the anæsthetic state. On the other hand, less attention has been paid to the *clinical* effects of anæsthesia and operations upon the very anæmic. The following sixty-one cases have been studied in order to obtain some idea of the clinical effects of operations upon, and the giving of a general anæsthetic to, anæmic patients.

Da Costa and Kalteyer[1] have analyzed the blood during and after fifty anæsthetizations and have concluded that the hæmoglobin is always reduced absolutely and state that, "on account of the hemolysis, a very low percentage of hæmoglobin must be regarded as a contraindication to the administration of a general anæsthetic." They report "one case operated upon with the hæmoglobin 30 per cent and another with 24 per cent," but unfortunately give us no details as to what the operations were or how long the anæsthetic was administered or the effect of the above on the patients.

It has not yet been proved just how general anæsthesia is produced or what part the blood plays in its production, and whether or not the percentage of hæmoglobin can be considered as an important factor in its production. It seems reasonable to suppose that a general anæsthetic would be more injurious to a patient whose blood is low in the oxygen-carrying constituents, than to an individual with a normal percentage of hæmoglobin. As we do not know just how anæsthesia is produced and what part the blood plays in its production, we can, perhaps, best rely on our clinical experience in drawing our conclusions.

An endeavor has been made to collect and review all the cases having a hæmoglobin percentage of fifty or less, which have been operated upon in the gynecological clinic of the Johns Hopkins Hospital. The list is incomplete in many ways: in several of the early cases a definite hæmoglobin percentage was not recorded, only remarks on the "extreme anæmia" having been made; in several cases the hæmoglobin after operation was not carefully followed with the view of noting its increase or decrease; some cases have undoubtedly been overlooked. Satisfactory notes, however, have been made by the anæsthetist, and it is from these notes, together with notes made during convalescence, supplemented by personal observation, that our conclusions have been reached.

Hæmoglobin.

In the articles referred to below, especially those of Bierfreund[3] from von Mikulicz' clinic, of Oliver,[9] and of Da Costa and Kalteyer,[1] especial attention has been paid to the actual reduction in the number of red blood-cells and the lowering of the hæmoglobin per cent during the giving of an anæsthetic. The results obtained are important and the conclusions drawn are of great value. It has been our aim to study, not so much what changes actually take place under anæsthesia as to note the manner in which patients with extremely low hæmoglobin percentages take an anæsthetic and the rapidity and character of their convalescence from operation.

The readings have been taken by the different house officers of the gynecological staff and have been made, for the most part, by means of the von Fleischl instrument, while a few readings have been taken with the instruments of Gowers and of Dare.

Many factors enter into every hæmoglobin estimation; the personal equation of the one taking the reading; the quality of the instrument used; the condition of the part from which the blood is taken; the previous treatment (catharsis, etc.) that the patient has had; and many others. It is partially on account of there being so many conditions influencing all of our hæmoglobin estimations, especially when a patient is under an anæsthetic, that we must look more to the *clinical* evidence of our cases for our help in deciding when to and when not to operate.

The average hæmoglobin percentage of all cases in the following series, taken before operation, is 38.3 per cent. Eight patients were operated upon with a hæmoglobin per cent of *less* than 30, and of these eight, one (No. 39) had 19 per cent and another (No. 54) had 15 per cent. After operation the hæmoglobin was recorded at intervals varying from 6 hours to 9 weeks, as will be seen from the table.

MYOMATA.

No.	Gyn. No.	Name.	Age.	Diagnosis.	Operation.	Length. of Op.	Length of Anæs.	Hgb. Before Op.	Hgb. After Op.	Result.	Remarks.
1	4369	M. R.	36	Myoma uteri.	Hystero-myo., left. Salpingo-oöphorectomy.		?	?	40 %-20 ds.	Recovery.	Convalescence slow. Phlegmasia Alba Dolens.
2	5447	M. H.	40	Myoma uteri.	Myomectomy.	12 mins.	50 mins.	Anæmic.	Anæmic.	"	Convalescence rapid.
3	5808	M. J.	53	Myoma uteri.	Hystero-myomectomy.	45 "	1½ hrs.	Marked hydræmia.	?	"	Advanced valvular heart disease. Exacerbation during convalescence.
4	5752	U. J. A.	41	Myoma uteri.	Hystero-myomectomy.	1¼ hrs.	2 hrs.	Very anæmic.	26 %-21 ds. 52 %-27 "	"	Convalescence slow. No complications.
5	6002	A. G.	34	Sub-mucous myoma.	Morcellement of myoma.	44 mins.	50 mins.	?	24 %-9 "	"	R. b. c. 1,700,000, 6 days aft. op. Convalescence rapid.
6	6424	L. R.	48	Myoma uteri.	Hystero-myomectomy.	1¼ hrs.	1½ hrs.	Marked anæmia.		"	Convalescence uninterrupted.
7	7036	M. A L.	44	Profuse, continuous uterine hemorrhages. Sub-mucous myoma. Asthenia.	Hystero-salpingo oöphorectomy.	2 hrs. 20 mins.	2½ "	"	"	Died.	Death on operating table from asthenia.
8	7438	A. W.	43	Myoma uteri.	Hystero-myo-salpingo oöphorectomy.	55 "	1 hr. 40 mins.	48 %	55 %-1 mo.	Recovery.	No complications.
9	8767	E. P.	44	Myoma uteri.	Pan-hystero-myomectomy.	1 hr. 7 mins.	1½ hrs.	50 %	67 %-10 ds.	"	
10	8804	M. P.	45	Sloughing myoma.	Curettage, irrigation and packing.	5 "	20 mins.	20 %	?	Death in 8 hrs.	Enlarged heart. Systolic murmur heard over entire cardiac area.
11	8934	L. P.	40	Sub-mucous myoma.	Pan-hystero-myomectomy.	1 hr. 25 mins.	1 hr. 55 mins.	33 %	?	Recovery.	No complications, Went home in good condition.
12	8951	E. M.	48	Myomata uteri.	Hysterectomy, vaginal.	55 "	47 "	37 %	?	"	
13	9053	H. W.	43	Myomata uteri.	Pan-hystero-myomectomy, abd.	?	1 hr. 20 mins.	35 %	47 %-3 wks.	"	Convalescence rapid. No complications.
14	9203	S. B.	36	Interstitial and sub-mucous myomata. Polypoid endomet.	Hystero-myomectomy, abd.	1 hr.	1 hr. 35 mins.	46 %	75 %-1 mo.	"	Condition excellent.
15	9291	U. P.	50	Myoma uteri.	Pan-hysterectomy, abd.	1 hr. 7 mins.	1 hr. 35 mins.	22 %	36 %-3 wks.	"	Rapid convalescence. No complications.
16	9293	M. S.	31	Myoma uteri.	Hystero-myomectomy, abd.	1 hr. 3 mins.	1 hr. 20 mins.	45 %	?	"	Ether well taken.
17	9678	N. D.	34	Myoma uteri. Abscess.	Myomectomy. Evacuation of abscess.	35 "	43 "	26 %	45 %-8 wks.	"	Mitral insufficiency. Chronic interstitial nephritis.
18	9707	A. C.	42	Myoma uteri.	Pan-hystero-myomectomy.	40 "	45 "	Anæmic.	26 %-14 ds. 55 %-5 wks.	"	Stood operation fairly well.
19	9786	M. B.	40	Myoma uteri. Tubo-ovarian abscess.	Pan-hystero-myomectomy.	1 hr. 10 mins.	1 hr. 50 mins.	43 %	55 %-3 "	"	Ether well taken. Rapid convalescence.
20	10172	W. B.	41	Myoma uteri.	Pan-hystero-myomectomy.	45 "	1½ hrs.	44 %	40 %-3 ds. 53 %-3 wks.	"	Convalescence rapid.
21	10872	D.	23	Sub-mucous myoma.	Vaginal myomect.	30 "	?	40 %	60 %-1 mo.	"	Slow in regaining color.
22	11077	E.	40	Myomata uteri.	Pan-hystero-myomect., abd.	35 "	1 hr.	22 %	25 %-9 ds. 29 %-12 " 80 %-35 "	"	Anæsthetic very well taken. Slight nausea following.
23	11139	J.	43	Myomata uteri. Sub-mucous, profuse hæmorrhage.	Pan-hystero-myomect., abd.	30 "	45 mins.	28 %	29 %-6 hrs. 40 %-20 ds.	"	Anæsthetic well taken. Considerable loss of blood. Not infused or stimulated. Returned to ward warm and in good condition, pulse 104.

CARCINOMA.

24	2248	S. L.	38	Carc. cervix uteri.	Pan-hysterectomy, abd.	2 hrs.	2 hrs. 45 mins.	Very anæmic.	?	Recovery.	
25	5443	W. J. T.	36	Carc. cervix uteri.	Pan-hysterectomy, abd.	35 mins.	1 hr. 15 mins.	Extreme anæmia.	?	Death under anæsthesia.	Basal and apical systolic murmurs.
26	9903	V. K.	44	Carc. cervix uteri.	Pan-hysterectomy. Double implantation of ureters into bladder.	3 hrs. 10 mins.	3 hrs. 5 mins.	45 %	?	Recovery.	Returned to ward in good condition. Ether well taken. Convalescence rapid and uninterrupted.
27	10627	F. B.	39	Carc. cervix uteri.	Pan-hysterect., abd.	3 hrs. 16 mins.	3 hrs. 35 mins.	45 %	?	"	Left hospital feeling perfectly well.
28	10677	M. P.	40	Carc. cervix uteri.	Pan-hysterect., abd.	1 hr. 30 mins.	1 hr. 35 mins.	45 %	?	Unimproved.	Rapid pulse following operation.
29	7819	B.	40	Carc. cervix uteri.	Pan-hysterect., abd.	2 hrs. 25 min.	3 hrs. 8 mins.	35 %	?	Recovery.	Profound shock but normal convalescence. Well 4 mos. aft. op.
30	9004	M. W.	49	Carc. cervix uteri.	Hysterectomy, vaginal.	1 hr. 14 mins.	1 hr. 45 mins.	33 %	30 %-1 mo.	"	Discharged well. Prognosis excellent.
31	7840	L. H.	44	Carc. cervix uteri.	Hysterectomy, vaginal.	1 hr. 50 mins.	2 hrs. 45 mins.	38 %	?	"	Anæsthetic well taken.
32	7454	H.	49	Carc. cervix uteri.	Ether exam. and curettage.	3 "	1 hr. 7 mins.	35 %	42 %-3 wks.		Diagnosis confirmed. Op. followed in 3 wks.
33	7495	H.	49	Carc. cervix uteri.	Vaginal hysterectomy.	1 hr.	2 hrs.	42 %	55 %-3 "	Recovery.	Rapid convalescence.
34	6581	A. C.	56	Adeno-carc. body and cervix.	Pan-hysterectomy, abd.	1 hr. 20 mins.	2 hrs.	Very anæmic.	?	"	No complications.

CARCINOMA.—*Continued.*

No.	Gyn. No.	Name.	Age.	Diagnosis.	Operation.	Length of Op.	Length of Anæs.	Hgb. Before. Op.	Hgb. After Op.	Result.	Remarks.
35	9911	G.	53	Carc. body, cervix and vagina.	Curettage.	25 mins.	40 mins.	35 %	58 % 2 wks.	Recovery.	Ether well taken.
36	10462	S.	51	Carc. body, uterus. Myoma uteri.	Pan-hysterectomy, abd.	1 hr.	1 hr. 10 mins.	50 %	?	"	Ether well taken. Uneventful convalescence.
37	9570	M. H.	48	Carc. body, uterus. Strangulated ovarian cyst.	Pan-hysterectomy, abd.	?	1 hr. 40 mins.	38 %	73 % 1 mo.	"	
38	9431	M. T.	56	Carc. cervix uteri.	Excision carcinomatous mass.	30 mins.	?	46 %	?	Improved.	Recovery from oper. uneventful.
39	7564	W.	50	Carc. cervix uteri.	Curettage.	15 "	55 mins.	19 %	37 %-1 wk. 44 %-3 wks. 53 %-5 "	Diagnosis made.	Hysterectomy 6 wks. aft. curettage. Recovery.
40	9387	M.	46	Carc. cervix uteri.	Curettage.	10 "	30 "	35 %	54 %-2 "	Recovery.	Ether well taken.
41	10130	K.	47	Carc. cervix uteri.	Curettage.	5 "	35 "	50 %	?	Unimproved.	Ether well taken.
42	10196	C.	33	Carc. cervix uteri.	Curettage.	20 "	47 "	45 %	?	"	Ether well taken.
43	8893	M. D.	67	Carc. bladder.	Resection anterior vaginal wall.	50 "	1 hr. 20 mins.	35 %	56 %-1 mo.	Recovery.	Convalescence prolonged on account of anæmia.
44	9257	K. E.	20	Carc. ovaries with general mesenteric and omental metastases.	Exploratory laparotomy.	35 "	37 "	43 %	?	Recovery (immediate).	Rapid pulse following operation.

POLYPOID ENDOMETRITIS.

45	10562	E. W.	44	Polypoid endometrium.	Pan-hysterect., abd.	55 mins.	1 hr. 30 mins.	45 %	?	Recovery.	Anæsthetic well taken. No complications.
46	9340	S. D.	50	Polypoid endometrium.	Pan-hysterect., abd.	?	1 hr. 25 mins.	29 %	?	"	Good health 3 mos. after.
47	8413	H. M.	44	Polypoid endometrium.	Pan-hysterect., abd.	55 mins.	1 hr. 20 mins.	38 %	52 % 24 ds.	"	Convalescence uninterrupted.
48	8905	E. K.	52	Polypoid endometrium.	Hysterectomy, vaginal.	1 hr. 10 mins.	1 hr. 40 mins.	44 %	?	"	Convalescence uninterrupted.
49	6128	S. H.	53	Polypoid endometrium.	Curettage.	5 "	27 "	?	33 %-20 ds.	"	Very anæmic. Rapid convalescence.
50	5511	W. J.	49	Polypoid endometrium. Hæmorrhoids.	Whitehead operation.	20 "	1 hr.	?	?	"	Excessive anæmia. Bleeding for 7 yrs.

EXTRA-UTERINE PREGNANCY.

51	10829	C. J.	25	Extra-uterine preg. Ruptured.	Evacuation of blood clots.	?	?	39 %	68 %-26 ds.	Recovery.	
52	7782	S. W.	42	Extra-uterine preg. Ruptured.	Removal.	1 hr. 10 mins.	2 hrs. 10 mins.	30 %	?	"	
53	[illegible]	N. S.	27	Extra-uterine preg. Ruptured.	Salpingo-oöphorectomy. Suspension of uterus.	1 hr. 10 mins.	1 hr. 35 mins.	40 %	35 %-8 ds.	"	Persistence of anæmia 1 mo. aft. op.
54	10678	L. McG.	25	Extra-uterine preg. Ruptured.	Right salpingectomy.	?	20 "	15 %	10 %-3 "	Died 3rd day.	Progressive diminution in hæmoglobin following operation.

MENORRHAGIA.

55	10165	L. E.	38	Menorrhagia. Cause?	Hystero-salpingectomy.	1 hr. 5 mins.	52 mins.	35 %	20 %-8 ds. 20 %-14 " 30 %-31 "	Recovery.	Tendency to hæmophilia. Mitral insufficiency.
56	10097	I. E. R.	43	Menorrhagia. Cause?	Curettage.	?	?	25 %	39 %-2 wks. 50 % 5 " 60 %-7 " 74 %-8 " 81 %-9 "	"	Nitrous oxide anæsthesia. Tonic aft. treatment.

MISCELLANEOUS.

57	10171	E. G. W.	48	Renal calculus. Pyonephrosis.	Nephro-lithotomy.	45 mins.	1 hr. 3 mins.	40 %	40 %-1 mo.	Improved.	Considerable loss of blood in operation.
58	10877	K.	38	Renal calculus. Pyonephrosis.	Nephro-lithotomy.	25 "	35 "	35 %	28 %-4½ hrs. aft. op. Infused 700 cc. 2 hrs. before reading.		Rapid convalescence.
59	9974	M. McL.	32	Hæmorrhoids, retro-position. Relaxed outlet.	Suspension of uterus. Repair relaxed outlet.	1 hr. 7 mins.	1 hr. 37 mins.	50 %	50 %-2 wks.	Recovery.	Anæsthetic well taken. Extreme shock following op. Rapid convalescence.
60	10094	M. S.	34	Deciduoma malignum.	Pan-hysterectomy, abd.	48 "	1 hr.	20 %	33 %-9 ds. 75 %-1 mo.	"	Stood op. well.
61	5759	M. T.	32	Retained membrances.	Curettage.	?	No anæsthesia.	?	38 %-5 ds. 46 %-16 " 53 %-24 "	"	Convalescence slow.

Both acute (emergency) cases and chronic cases have been considered and will be discussed more in detail later. A few cases operated upon early in the history of the hospital have not a definite hæmoglobin percentage recorded, but only those have been considered where especial reference to a "marked anæmia" has been made.

The hæmoglobin per cent has been estimated simply in order to have a basis to work on, but the cases have been considered primarily with reference to, (1) the character of the operation, (2) the length of the anæsthesia, (3) the character of the convalescence and (4) the occurrence of post-operative complications.

Treatment Preliminary to Operations.

Several cases in the above series were subjected to a preliminary tonic treatment before operation was attempted, the treatment lasting from ten days to three and one-half months, and consisting in the administration of the usual tonics—Blaud's pills, Fowler's solution, tinct. nux vomica, etc., accompanied by rest in bed, fresh air and careful nursing. The following cases received such treatment:

No.	Gyn. No.							
14	9203	Hæmoglobin	raised	from	15%	to	46%	in 3½ months.
8	7438	"	"	"	19	"	48	" 1 "
17	9678*	"	"	"	23	"	26	" 1¼ "
20	10172	"	"	"	29	"	44	" ¾ "
47	8413	"	"	"	25	"	38	" 10 days.
19	9786	"	"	"	20	"	43	Time not stated.
27	10627	" 45%. Tonic treatment 10 days produced no change.						

*In this case no tonic treatment was given, patient simply put to bed and "watched."

The above cases show in a somewhat striking manner the value of tonic treatment preceding operative procedures, as far as increasing the amount of hæmoglobin in the blood is concerned, although it will also be noted that the convalescence in these cases was none the more rapid or uneventful than was that in many cases operated upon while having a much lower hæmoglobin percentage and having had no preliminary treatment. If, however, it is possible in a comparatively short space of time to raise the hæmoglobin percentage from 20 to 25 points, one would hardly seem justified in not giving the patient this benefit, however sure one might feel of performing a successful operation without preliminary "building up." Emergency cases are, of course, not considered here as in such cases our only method of procedure is immediate operation, whatever may be the hæmoglobin percentage.

It has been suggested that only the lightest preparation be given to anæmic patients before operation, *e. g.*, a mild cathartic or none at all, and only one enema, with the idea of not weakening a patient any more than can be helped. What few "emergency" cases there are in the above series had, of course, no preliminary preparation. The other cases, like those with higher hæmoglobin percentages, received the full routine preparation for operation, viz.: nothing but liquids after 10 a. m. the day preceding operation; Epsom salts ℥i at 12 noon, repeated at 3 p.m.; enema (oil and glycerine), 8 p.m.; enema (soap suds with turpentine and glycerine), 5 a. m., repeated till "clear." In other words, the immediate preparation for operation of our patients has not been varied in these special cases, and they have, practically, received throughout the same treatment that all of our cases receive.

Anæsthesia.

The anæsthetic used has been ether alone or the nitrous-oxide-ether sequence in every case but one, none of the patients having received chloroform. The method of administration has been invariably the commonly-called "open method," that is, a simple blotting-paper cone covered with oiled muslin and cloth, having a small sea sponge in the apex. Anæsthetics have been administered by the house officers in turn, no regular anæsthetist being employed.

The average length of anæsthesia was one hour and ten minutes. The longest anæsthetization was 3 hours and 35 minutes (No. 27, panhysterectomy abd., carcinoma of cervix, hæmoglobin 45 per cent), and the shortest 20 minutes (No. 10, curettage, sloughing myoma, hæmoglobin 20 per cent, and No. 54, salpingectomy, ruptured extra-uterine pregnancy, hæmoglobin 15 per cent).

As will be seen from the above table, the usual remark made by the anæsthetist on the ether chart, which is kept for every operation, is, "Anæsthetic well taken."

In looking over the post-operative notes made on the wards, it is surprising to learn how well these patients with low hæmoglobin percentages recover from their anæsthetic and how seldom the regular routine for patients after operation has had to be varied in these special cases. Neither nausea nor vomiting has been more marked with these patients, and indeed it has, in many, been entirely absent. Saline infusions have in a few of the cases been given on return to the ward, but oftener as a prophylactic measure than for definite indications.

The exact amount of ether used has not been recorded in a sufficient number of cases to allow of its being tabulated. In those cases where especial attention has been paid to this point, it has been noted, as might be expected, that the amount of the anæsthetic required to produce and maintain surgical anæsthesia has been much less in the extremely anæmic than in healthy persons. Indeed, a surprisingly small amount was required in several cases, considering the open method by which the ether was given and the consequent waste. There are so many conditions influencing the amount of an anæsthetic required, beside changes in the blood itself, that it is difficult to draw conclusions on this point. We agree, however, with Hewitt who states in his "Anæsthetics and their Administration,"[1] that "anæmic patients take anæsthetics very well, small quantities being required to secure tranquil anæsthesia." Hamilton Fish[2] has taken the opposite view, namely, that anæmic patients stand operations and also anæsthesia badly. He states that "a so-called physiological dose of an anæsthetic vapor for an individual whose blood shows a hæmoglobin percentage of 80 per cent, would be a pathological dose in the same individual showing a hæmoglobin percentage of 50 per cent or less." It is difficult to speak of "dosage" in regard to an anæsthetic, and a patient with a hæmoglobin percentage of 50 would not be given the same "dose" as a patient with 80 per cent because he would not require it.

Fish also attributes respiratory failure to a lowering of the hæmoglobin per cent below 20 and cites three cases of von Mikulicz dying of operative collapse, 15 per cent of hæmoglobin being found remaining in the blood. Patients Nos. 15, 22 and 60 were each anæsthetized for at least one hour, the hæmoglobin being 22 per cent in the first two and 20 per cent in the third. There was no respiratory distress or failure in any of these cases, nor was there any in case No. 54, where the anæsthetic was administered for 20 minutes to a patient having a hæmoglobin per cent of 15. Our cases have, on the contrary, been singularly free from respiratory distress.

The administration of an anæsthetic to the anæmic is far from being without its dangers. Here our "working area" between too light anæsthesia and the danger point of too deep an anæsthesia is considerably lessened and the patient must be closely watched. So little of the anæsthetic is, however, usually required, that, unless the operation be unfortunately complicated by hemorrhage, the administration is easy and reasonably safe.

Da Costa and Kalteyer[1] come to the following conclusion in regard to the giving of a general anæsthetic to anæmic individuals: Finding an absolute corpuscular reduction in hæmoglobin in all cases, they state that a general anæsthetic must not be administered, unless under stress of absolute necessity, if the hæmoglobin is below 40 per cent. The limit set by Hamilton Fish is 50 per cent; that set by von Mikulicz, 30 per cent. In the fifty cases in which the blood changes under anæsthesia were studied by Da Costa and Kalteyer, no case has been considered in which the hæmoglobin was below 50 per cent, and only four cases with hæmoglobin below 70 per cent. These cases were studied with reference to the blood changes alone, without especial regard to the behavior of the patient both during and after anæsthesia. These experiments, performed with the utmost care, have apparently demonstrated the actual corpuscular loss of hæmoglobin in most cases, taking the color index of the blood before and after operation as a basis. Many factors, however, as stated by the authors, enter into determinations of this kind and help influence results. Granting that there is an actual corpuscular loss of hæmoglobin under anæsthesia, it is quite justifiable on purely theoretical grounds to have, as a guide, a definite standard of hæmoglobin per cent and to refuse to operate when the blood fails to come up to this standard. With a view of determining how actual this standard is, the present study of cases with hæmoglobin under 50 per cent has been made.

Convalescence.

The short notes appended to the above table give a general idea of the character of the convalescence. The immediate results of the anæsthetic have been considered under that heading.

There seems to have been little difficulty in producing a movement of the bowels after operation by means of the routine treatment, which consists of calomel grains II to III given the night of the second day after operation (day of operation being counted as the first day), an ounce of Epsom salts the next morning, followed in three hours by an enema.

Post-operative infections have been few. The blood, with low resistance before operation and with possibly a much lower resistance to infection after operation, has taken care of infections well. In only one case, No. 1, was any trouble at all met with. In this case a femoral phlebitis developed, but soon subsided, and the patient got entirely well. That the phlebitis was the result of the anæmia is possible but not probable. There was no breaking down or infection of wounds in clean cases. Incisions healed rapidly and firmly.

As a general rule, the convalescence was rapid and uninterrupted. In a few cases the recovery seemed to be much prolonged and was attributed to the anæmia alone. These cases were Nos. 21, 43, 53 and 1.

In the early cases reported especial attention was not paid to "tonic" after-treatment. In case No. 53 the anæmia persisted after operation in spite of continued attempts to nourish the patient and to raise the hæmoglobin percentage. She got perfectly well, improving slowly after leaving the hospital. In case No. 54 we have what might be called the extreme lower limit of our series. The hæmoglobin never regained its original level at the time of operation (15 per cent), and the patient died on the third day. In this case, which was one of ruptured extra-uterine pregnancy, no operation would have been performed had it not been absolutely necessary. It was strictly an emergency condition.

On the whole the convalescence of our anæmic patients has proven quite satisfactory and much more rapid than one would expect from the conditions present at the time of operation.

Classification.

I. Myomata.

Of myomata there were 23 cases with two deaths.
The cases may be divided as follows:

1.	Myoma	requiring	hysterectomy	(abd.)	17	cases.
2.	“	“	“	(vag.)	2	“
3.	“	“	myomectomy		2	“
4.	“	“	curettage		2	“

In the cases in which hysterectomy was performed:

The average length of operation	was	1 hour 3 minutes.
“ “ “ “ anæsthesia	“	1 “ 30 “
“ longest “	“	2½ hours.
“ lowest hæmoglobin per cent	“	22%
“ highest “ “	“	50%
“ average “ “	“	38%

In the other six cases:

The average length of operation	was	30 minutes.
“ “ “ “ anæsthesia	“	42 “
“ longest “	“	50 “
“ lowest hæmoglobin per cent	“	20%
“ highest “ “	“	40%
“ average “ “	“	30%

Of these 23 cases all but 2 recovered and were discharged from the hospital well. Both fatal cases were extremely sick patients. Both had submucous myomata, both had bled profusely, and No. 10 was an infected case having a hæmoglobin per cent of 20 and broken cardiac compensation.

II. *Carcinoma.*

We have in our series 21 cases of carcinoma, which may be divided as follows:

1.	Carcinoma of cervix of the uterus	15
2.	" " " and body	2
3.	" " body of the uterus	2
4.	" " ovaries	1
5.	" " bladder	1

1. Carcinoma of cervix.
   (a) In 9 cases hysterectomy was performed.
   (b) In 6 cases curettage.

(a) In the 9 cases in which hysterectomy was performed:

The average length of operation	was	1 hour 53 minutes.
" " " " anæsthesia	"	2 hours 28 "
" longest anæsthetization	"	3 " 35 "
" average hæmoglobin per cent	"	40%
" lowest " "	"	33%
" highest " "	"	45%

(b) In the 6 cases in which curettage only was done:

The average length of operation	was	13 minutes.
" " " " anæsthesia	"	46 "
" longest anæsthetization	"	1 hour 7 minutes.
" average hæmoglobin per cent	"	38%
" lowest " "	"	19%
" highest " "	"	50%

Of these 15 cases, all but one (No. 25) recovered from operation and were discharged from the hospital. In the one fatal case, in which the hæmoglobin per cent was not taken, "extreme anæmia" was present. The patient had both basal and apical heart murmurs and died on the table after ether had been administered for 1 hour and 15 minutes.

2. In the remaining 6 carcinoma cases:

The average length of operation	was	50 minutes.
" " " " anæsthesia	"	1 hour 14 minutes.
" longest "	"	2 hours.
" lowest hæmoglobin per cent	"	35%
" highest " "	"	50%
" average " "	"	40%

All of these six cases recovered from the operation well, although in two cases no permanent benefit could be given on account of the extent of the growth.

III. *Polypoid Endometritis.*

There were 6 cases with no deaths. In 4 cases hysterectomy was performed. In 2 cases dilatation and curettement. In the 4 cases where hysterectomy was performed,

The average length of operation	was	1 hour.
" " " " anæsthesia	"	1 hour 29 minutes.
" longest "	"	1 " 40 "
" lowest hæmoglobin per cent	"	29%
" highest " "	"	45%
" average " "	"	39%

The two cases, Nos. 45 and 46, may well be compared as regards length of anæsthesia and operation and character of convalescence, while on the other hand one patient showed a hæmoglobin per cent of only 29, but the other 45 per cent. Both patients were over 40 years of age.

IV. *Extra-Uterine Pregnancy.*

There were 4 cases with one death.

The average length of operation	was	1 hour 10 minutes.
" " " " anæsthesia	"	1 " 22 "
" longest "	"	2 hours 10 "
" lowest hæmoglobin per cent	"	15%
" highest " "	"	40%
" average " "	"	31%

All the cases had ruptured, blood being present in the abdominal cavity. Case No. 52 is remarkable for the length of time (2 hours and 10 minutes) during which the patient received the anæsthetic while having a hæmoglobin per cent of only 30. The anæsthetic was well taken and the patient made a rapid and uneventful recovery.

The fatal result in case No. 54 was expected even sooner than it occurred. The taking of the anæsthetic for twenty minutes seemed to have but little effect one way or the other, on the general condition.

V. *Menorrhagia.* (Cause not stated.)

2 cases.	No deaths.
Average Hgb.	30%
Lowest	25%
Highest	35%

Case No. 55 proved an interesting one. The operation consisted in the removal of the uterus and both tubes and lasted for 1 hour and 5 minutes, the anæsthesia lasting 52 minutes. Complications were, (1) mitral insufficiency, and (2) a distinct tendency to hæmophilia, which in itself might be considered a contraindication to any prolonged operation. There was a decided diminution in the hæmoglobin percentage following the operation, it reaching only 30 per cent 31 days after the operation. Even under these adverse conditions the patient stood the anæsthetic well and was sent home at the end of one month much improved generally.

Case No. 56 was the only one in the series where ether was not used, the patient being given here only the nitrous oxide gas—hgb. 25 per cent. The patient was 43 years old. The rapid increase in hæmoglobin following operation is shown in the above table.

Case No. 61 is included in the series for the purpose of comparison. Hæmoglobin per cent before operation was not stated. No anæsthesia was given to the patient. A simple curettage was performed for bleeding from retained membranes. It is noted in the history that the convalescence in this case was "slow," although there was a satisfactory increase in the hæmoglobin following the operation. From a comparison with other cases it would seem as though an anæsthetic might have been safely given to this patient also, had one been needed for a more thorough examination or operation.

We have left cases Nos. 57, 58 and 60. No. 60 was especially satisfactory, as here a radical abdominal operation was demanded from the nature of the case (deciduoma malignum) and was performed, although the hæmoglobin registered only

20 per cent. The anæsthetic was administered for one hour. The patient stood the operation and the anæsthesia "well" and made a rapid and very satisfactory recovery.

Patient No. 58 was desperately ill—an emergency case (nephrolithiasis with pyonephrosis). Patient looked extremely anæmic, although the hæmoglobin proved to be 35 per cent. Recovery from operation rapid. The kidney was removed later when the hæmoglobin had reached 67 per cent.

Results.

Sixty women, each showing a hæmoglobin percentage of 50 or less, have received a general anæsthetic for operative purposes, the duration of the anæsthesia varying from twenty minutes to three and one-half hours.

Fifty-six of the sixty cases had uneventful recoveries. There were four fatalities, Nos. 7, 10, 25 and 54. Severe heart lesions complicated two of these; in the third, the patient had already bled till her hæmoglobin registered 15 per cent, and in the fourth case the anæsthetic had been given for two and one-half hours before the patient showed any signs of immediate collapse.

Two cases only died on the table under the anæsthetic.

The worst shocked patient of all was No. 59, upon whom, with a hæmoglobin percentage of 50, an ordinary suspension of the uterus and repair of relaxed vaginal outlet were performed, the operations consuming an hour and seven minutes.

The patients, as a rule, have taken the anæsthetic well. There has been no respiratory distress noted, and in neither of the cases dying on the table was respiratory failure primarily the cause of death.

Recovery from the anæsthetic and the following convalescence has been satisfactory in a great majority of the cases. In no case was it thought that the persistence of the anæmia after operation was in any way prolonged by the giving of the anæsthetic.

Preliminary tonic treatment proved of value in raising the hæmoglobin percentage in the six cases in which it was tried.

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A CONTRIBUTION TO THE STUDY OF CYSTINURIA.*

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Historical Survey.

While the sulphur and nitrogen content of cystin had long been recognized as evidence of the albuminous origin of the substance, either directly or indirectly, nothing practically was known of the manner of its formation and its rôle in the sulphur metabolism of the body until a comparatively recent date.

The first important papers in which the subject was approached from the experimental side were published in 1881 by Baumann and Preusse[1] and Jaffe.[2] It was shown that on feeding normal dogs with halogen substitution products of benzol, the aromatic radicles C_6H_4Br—, C_6H_4Cl—, etc., combine with an organic sulphur body to form compounds which are termed mercapturic acids. These in turn appear in the urine in combination with glucuronic acid. According to the character of the aromatic radicle we speak of a bromphenyl mercapturic acid, a chlorphenyl mercapturic acid, etc. Further study of these bodies showed that on hydrolysis they are decomposed into acetic acid and a substance which, in the case of brombenzol, has the composition $C_9H_{10}Br\ SNO_2$. This was identified as bromphenyl-cysteïn, viz., as cysteïn in which one hydrogen atom had been replaced by the univalent C_6H_4Br— group. Providing that this cysteïn could be shown to be identical with the cysteïn which results on reduction of the common cystin found in the urine of cystinuric individuals, there would thus be evidence to show that cysteïn, viz., cystin, represents a normal product of the sulphur metabolism of the body.

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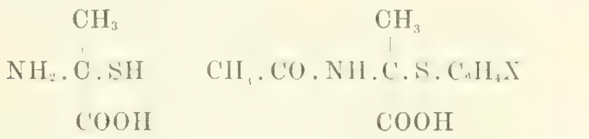
* Read in abstract before the Hospital Med. Soc'y., May 2, 1904.

[1] Baumann and Preusse: Zur Kenntniss der synthetischen Prozesse im Thierkörper. Zeit. f. phys. Chem., 1881, vol. XV, p. 309.

[2] Jaffe: Ber. d. deutsch. Chem. Ges., vol. XII, p. 1092.

Within recent years this has been definitely established, and the formation of mercapturic acids in the body of the dog can accordingly be regarded as an experimental cystinuria, as Baumann first suggested. Baumann's views regarding the structure of the mercapturic acids and of cystin have undergone a certain modification, however, for Friedmann[3] has shown that the thio-group of cysteïn occupies the β-position and the amido group the α-position, and that Baumann's mercapturic acids have a corresponding structure.[4] The difference from Baumann's original conception is expressed in the formulæ:

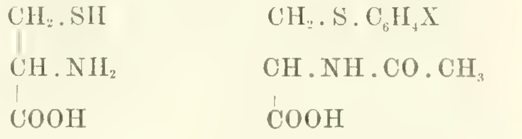
Baumann's formulæ:



$$\begin{array}{c} CH_3 \\ | \\ NH_2.C.SH \\ | \\ COOH \end{array} \qquad \begin{array}{c} CH_3 \\ | \\ CH_3.CO.NH.C.S.C_6H_4X \\ | \\ COOH \end{array}$$

Cysteïn Mercapturic acid

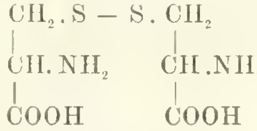
Friedmann's formulæ:



$$\begin{array}{l} CH_2.SH \\ | \\ CH.NH_2 \\ | \\ COOH \end{array} \qquad \begin{array}{l} CH_2.S.C_6H_4X \\ | \\ CH.NH.CO.CH_3 \\ | \\ COOH \end{array}$$

Cysteïn Mercapturic acid

The cystin formula is accordingly:

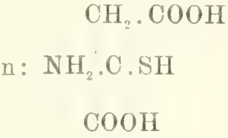


$$\begin{array}{ll} CH_2.S - & S.CH_2 \\ | & | \\ CH.NH_2 & CH.NH_2 \\ | & | \\ COOH & COOH \end{array}$$

i. e., it is α-diamido-β-dithio-dilactic acid.

The correctness of Friedmann's deductions has been corroborated by the synthetic formation of the substance by Erlenmeyer.[5]

Regarding the mother substance of cystin, Baumann assumed the existence in the albuminous molecule of a sulpho-asparaginic acid group, of the composition:



$$\begin{array}{c} CH_2.COOH \\ | \\ NH_2.C.SH \\ | \\ COOH \end{array}$$

This supposition was largely based on Suter's[6] inability to demonstrate cystin among the hydrolytic decomposition products of keratin. Later researches by Mörner[7] and Embden,[8] however, have shown that cystin is a constant decomposition product of the keratins, not only, but of nearly all the common albumins also, and that there is good reason for assuming that the greater portion, if not all, of the sulphur exists in the albuminous molecule in the form of a cystin, or a cysteïn complex. Patten[9] then has shown that cystin is the primary form in which the substance is liberated on hydrolysis, and that cysteïn whenever present has resulted from the cystin secondarily. This albuminous cystin, as it may be termed, is in all respects identical with the cystin obtained from the urine of cystinuric individuals, and the corresponding cysteïn with that which forms the sulphur nucleus of the mercapturic acids.

In the light of these investigations there can be no doubt that cystin represents a normal intermediate product in the sulphur metabolism of the body, and that its occurrence in the urine of cystinuric individuals can scarcely be the expression of a deviation from the normal katabolism so far as its primary formation is concerned. As the substance is not found in the urine under normal conditions, however, we can infer that following its primary formation it is eliminated in altered form, while this does not occur, or does so at least to a less extent in the cystinuric individual.

The first systematic investigations which were undertaken with the object of studying the fate of cystin in the animal body were made by Goldmann.[10] He could show that it is possible in dogs to thus increase the output of non-oxidized sulphur of the urine by feeding with chlorbenzol that the ratio of the non-oxidized to the oxidized form, which in dogs is normally 0.38 : 1 (average of seven analyses), can rise to 3.1. The conclusion thus appeared quite justifiable that normally the cystin, viz., cysteïn, is for the most part oxidized to sulphuric acid, and that it accordingly represents an antecedent of the urinary sulphates. This was further confirmed by an experiment in which a dog was fed 2.02 grms. of cysteïn. The oxidized sulphur, which had been 0.3576 grm. the day before, rose to 0.80 and the non-oxidized sulphur from 0.0984 to 0.26. The ratio between the two remained constant. Two-thirds of the ingested cysteïn-sulphur were thus eliminated in completely oxidized form, while one-third went to increase the non-oxidized sulphur. So far as this second portion is concerned, Goldmann could show that the cysteïn was not eliminated as such, as on boiling the urine with caustic alkali and lead acetate no separation of lead sulphide occurred; that a transformation into sulphocyanides had not taken place could likewise be demonstrated. Noteworthy also is the observation that the non-oxidized sulphur bodies of the dog's urine (even normally) were not destroyed as a result of putrefactive changes. A small amount of hydrogen sulphide is formed, which, however, is derived from the sulphates. Goldmann concludes that the ingested cysteïn underwent the same change as is normally the case with the albuminous sulphur.

The only other feeding experiments with cystin, in which the sulphur elimination of the urine was studied, are those of

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[3] Friedmann, E. Hofmeister's Beiträge, 1902, vol. III.

[4] Friedmann, E.: Ibid., 1903, vol. IV.

[5] Erlenmeyer: Ber. d. deutsch. chem. Ges., 1903, vol. XXXVI, p. 2720.

[6] Suter, F.: Zeit. f. phys. Chem., 1895, vol. XX, p. 565.

[7] Mörner, K. A. H.: Zeit. f. phys. Chem., 1899, Vol. XXVIII, p. 595, and 1901-02, and vol. XXXIV, p. 207.

[8] Embden, G.: Ibid., 1901, vol. XXXII, p. 94.

[9] Patten, A. J.: Ibid., 1903, vol. XXXIX, p. 350.

[10] Goldmann, E.: Zeit. f. phys. Chem., 1885, vol. IX, p. 260.

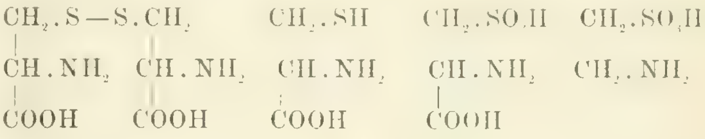
Blum.[11] These were undertaken with the view of testing the hypothesis that cystinuria in the human being might be the result of a more extensive albuminous cleavage than normal, with coincident excessive liberation of cystin. His results show quite conclusively that this view is not tenable. Following the administration of cystin (to dogs) in toxic doses even, cystinuria could not be produced. In these investigations the total non-oxidized sulphur was not determined, but merely that portion from which the sulphur can be split off by boiling with caustic alkali. In one instance it was found that after the administration of 4.5 grms. of cystin there was a marked increase of the oxidized sulphur, while the non-oxidized form was only slightly affected; as a result the percentage amount of the non-oxidized form as compared with the total sulphur was diminished. In a second experiment there was a great increase of both forms, with a coincident rise of the percentage amount of non-oxidized sulphur from 6.03 to 13.22. In this case an excessive amount of cystin had been given, which caused the death of the animal within thirty-six hours. Even here no cystin could be demonstrated in the urine, which shows that in the normal dog at least the organism is capable of so altering any cystin which has been fed by the mouth, that it is no longer demonstrable as such, a considerable portion being oxidized to sulphuric acid. So far as the non-oxidized fraction is concerned, it seems that in the dog a considerable portion can be eliminated in the form of thiosulphates, although this does not occur necessarily, as shown in the first instance, where the non-oxidized sulphur was scarcely increased.

Similar results were obtained by feeding with cysteïn. Cystin could at no time be demonstrated, but the thiosulphates were markedly increased.

In one experiment, in which 1.1 grm. of cystin was given subcutaneously, there followed a corresponding increase of the oxidized, but not of the non-oxidized sulphur.

These experiments thus show that in normal dogs cystin, when introduced in moderate amounts by the mouth or subcutaneously, is largely oxidized to sulphuric acid, while a smaller fraction is eliminated in non-oxidized form, which, however, is not cystin. Its intravenous injection, on the other hand, may give rise to genuine cystinuria. This depends primarily upon the rapidity with which the cystin is introduced and the vein which is selected. Generally speaking cystinuria will result, if the cystin is introduced into a peripheral vein, while this does not occur, if it is made to pass through the liver. Its injection, in this way, unless it is done rapidly and under pressure, increases the oxidized, but scarcely the non-oxidized sulphur. This difference in result which follows the injection of cystin into a peripheral, as compared with a mesenteric vein for example, may be referable to the slowness with which the substance reaches the systemic circulation; but, on the other hand, there is a possibility that the cystin may be changed to taurin in the liver. The possible genetic relationship between the two bodies has been suggested long ago and was urged especially by Marowsky[12] on the basis of the occurrence of cystinuria in a patient suffering from hepatic cirrhosis with coincident chronic total acholia. Marowsky inferred that in this case the cystin occurred vicariously in place of the taurin.

Notwithstanding the many objections which have been urged against this inference, the case has gained in interest from the fact that the suspected chemical relationship between the two bodies has recently been definitely established by Friedmann.[13] Friedmann succeeded in oxidizing cystin to cysteïnic acid, which may be viewed as the sulpho-acid of cysteïn, and on heating this with water in the sealed tube he obtained taurin. The relationship between these bodies is expressed by the formulæ:



$$\begin{array}{lllll}
CH_2.S-S.CH_2 & & CH_2.SH & CH_2.SO_3H & CH_2.SO_3H \\
| & | & | & | & \\
CH.NH_2 & CH.NH_2 & CH.NH_2 & CH.NH_2 & CH_2.NH_2 \\
| & | & | & | & \\
COOH & COOH & COOH & COOH &
\end{array}$$

Cystin Cysteïn Cysteïnic acid Taurin

This observation has thrown material light on the possible origin of taurin, of the antecedents of which nothing was formerly known beyond the fact that, like cystin, it was in some manner derived from the albumins. The feeding experiments with cystin, which have been considered above, have shown that a portion of the cystin sulphur, at any rate, is eliminated in the urine. How much of the ingested cystin sulphur is excreted in this manner cannot be determined from the available data; it appears, however, that as a general rule this is quite considerable. Under the circumstances corresponding observations on the sulphur output in the bile promised a great deal of interest. In dogs this is dependent exclusively upon the taurocholic acid, and sulphur estimations in such cases can accordingly be referred directly to taurin. Such experiments have recently been made by v. Bergmann.[14]

The results show the interesting fact that the administration of moderate amounts of cystin (2-2.5 grms.) alone does not lead to an increased elimination of the bile sulphur, but that this occurs if the animal is fed at the same time on cholalic acid. In this manner then the biological proof also has been furnished of the genetic relationship between cystin and taurin.

To sum up, there is evidence to show that under normal conditions the sulphur of the albuminous molecule is set free in the form of cystin, that this is in part eliminated in the bile as taurocholic acid, while another portion is excreted in the urine in completely oxidized form and a small fraction as non-oxidized sulphur, which, however, is no longer cystin. Of the intermediate products which are formed but little is known. In the past it has been tacitly assumed that the formation of taurocholic acid takes place through the direct union of taurin and cholalic acid, analogous to the formation of hippuric acid, as represented by the equation:

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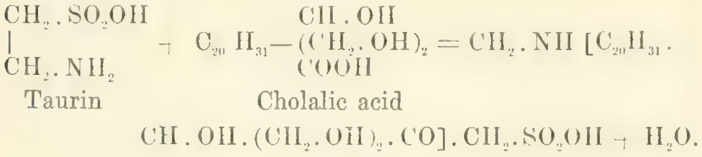
[11] Blum, L.: Hofmeister's Beiträge, 1903, vol. V, p. 1.

[12] Marowsky: Deutsch. Arch. f. klin. Med., 1868, vol. IV, p. 449.

[13] Friedmann: Hofmeister's Beiträge, 1902, vol. III, p. 1.

[14] v. Bergmann: Hofmeister's Beiträge, 1903, vol. IV, p. 192.



$$\begin{matrix} CH_2.SO_2OH \\ | \\ CH_2.NH_2 \end{matrix} + C_{20}H_{31}-\begin{matrix} CH.OH \\ (CH_2.OH)_2 \\ COOH \end{matrix} = CH_2.NH[C_{20}H_{31}.CH.OH.(CH_2.OH)_2.CO].CH_2.SO_2OH + H_2O.$$

Taurin Cholalic acid Taurocholic acid

But, on the other hand, there is evidence to show that the cystin may unite in the liver directly with the cholalic acid and that the resulting compound is then oxidized to taurocholic acid. Blum[15] thus found after injecting 5.6 grms. of cystin into a mesenteric vein of a dog that the liver two hours later contained no taurin; in the bile, however, a substance could be demonstrated from which sulphur could be split off on boiling with caustic alkali, whereas this is not possible under normal conditions, nor, according to v. Bergmann, after feeding dogs with moderate amounts of cystin. Blum could not isolate the body in question, but from his experiments it is clear that the sulphur reaction could not have been referable to cystin in the free state.

Granting the possibility, therefore, that the production of taurocholic acid may occur in this manner, viz.: without the intermediary formation of taurin, it appeared of interest to ascertain in what manner the cystinuric individual would react to the administration of cholalic acid. We were fortunately able to obtain such a case, who consented to act as subject of investigation. As there was a possibility, however, that the sulphur metabolism in man might differ in some respects from the corresponding process in the dog, it was deemed advisable to make control examinations in a non-cystinuric individual, who should receive both cystin and cholalic acid. Mester[16] had shown, as a matter of fact, that in man a recognizable formation of mercapturic acid does not occur following the administration of brombenzol, and Stadthagen[17] found that human urine normally contains no non-oxidized sulphur bodies with the exception of sulphocyanides, from which the sulphur can be split off on boiling with caustic alkali, while in dogs traces of cysteïn are probably normal. We believe that our investigations in this direction, both in the case of the normal as well as the cystinuric individual, are the first which have been undertaken in man.

PERSONAL STUDIES.

The technical details of our work follow:

Preparation of the Cystin.—The cystin which was used in our experiments was prepared from human hair in the manner described by Friedmann.[18] To this end 500 grm. lots were boiled on the sand-bath with 1500 cc. of concentrated hydrochloric acid (sp. gr. 1.19) for at least four hours. On cooling a concentrated solution of sodium hydrate is slowly added until the reaction is just acid (an alkaline reaction must be avoided). The mixture is then boiled for three-quarters of an hour with animal charcoal, which should be repeatedly added in liberal amounts, and filtered while still hot. On cooling, impure cystin separates out on standing. This is collected on a filter, dissolved in hot 10 per cent ammonia and reprecipitated by adding glacial acetic acid until the reaction is strongly acid. By redissolution and reprecipitation, and if necessary by final spontaneous evaporation of the ammonia, the cystin is ultimately obtained in pure form. Sometimes no separation of cystin occurred from the primary solution on cooling; in that case glacial acetic acid was added, when after twenty-four hours a copious sediment of impure cystin was always obtained, which was then purified as just described. The substance is finally collected on a filter, washed with water, then with alcohol and finally with a small amount of ether. In this manner a product was obtained which was free from tyrosin and in which the crystals presented the characteristic hexagonal form.

Preparation of the Sodium Cholate.—The cholalic acid which was used in our experiments was kindly presented to us by Dr. John J. Abel, of the Johns Hopkins Medical School, to whom we wish to express our indebtedness also at this place. The sodium salt was prepared by dissolving the cholalic acid in as little boiling absolute alcohol as possible, and treating this solution with a corresponding amount of alcoholic sodium hydrate solution (0.0964 NaOH for 1 grm. of cholalic acid). The resulting solution was filtered, while hot, and the filtrate treated with a large excess of ether. On standing the sodium cholate separates out in crystalline form and is filtered off, dried over calcium chloride, and stored for use.

Diet.—The diet in both individuals was constant. Case S. received daily: 250 cc. of milk, 150 grms. of bread, 30 grms. of butter, 4 whole eggs, 175 grms. of lean beef, 30 grms. of rice, 100 grms. of mashed potatoes, 300 cc. of bouillon, 150 cc. of coffee, 200 cc. of tea (both with sugar), and 75 grms. of stewed prunes.

M.'s diet consisted of 325 cc. of milk, 150 grms. of bread, 30 grms. of butter, 4 whole eggs and the whites of two additional eggs, 150 grms. of ham, 175 grms. of lean beef, 30 grms. of rice, 100 grms. of mashed potatoes, 300 cc. of bouillon, 125 cc. of coffee, 200 cc. of tea (both with sugar), and a dish of stewed prunes.

Analytical Methods.—The oxidized sulphur was determined according to Salkowski, and the total sulphur according to Glaser-v. Asbòth, in the modification suggested by Modrakowsky.[19] To this end a couple of grammes of sodium peroxide are placed in a nickel dish and covered with 50 cc. of urine, which is added drop by drop. The fluid is evaporated on the water-bath to a syrup and further treated with 2 or 3 grms. of the peroxide, which is slowly added while stirring. The dish is then removed from the water-bath and heated with a small alcohol flame. If necessary a few more grammes of the peroxide are added. The mass now forms a brown, oily material and finally becomes thick. This ends the reaction. On cooling the fusion is dissolved in water, and the solution filtered and acidified with hydrochloric acid. Barium chloride is then added and the process continued in the usual manner.

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[15] L. c., p. 13.

[16] Mester, B.: Zeit. f. phys. Chem., 1890, vol. XIV, p. 147.

[17] Stadthagen: Ibid., 1885, vol. IX, p. 136.

[18] L. c.

[19] Modrakowsky: Zeit. f. phys. Chem., 1903, vol. XXXVIII, p. 562.

By deducting the oxidized from the total sulphur the non-oxidized or neutral sulphur is obtained. So far as the control case goes, these values were really what we desired. In the cystinuric individual, however, we should have preferred a method by which the cystin could have been estimated as such. Abderhalden[20] has recently recommended a method for this purpose, which is based upon the isolation of the cystin from the urine as a β-naphthalin-sulpho compound, but unfortunately we were not able to procure the necessary reagent at the time when our cystinuric individual was available.

Baumann's benzoylation method is not applicable for the purpose,[21] and the estimation of the loosely combined sulphur and its interpretation as cystin sulphur also did not appear to offer any material advantages over the estimation of the neutral sulphur. Baumann and Goldmann[22] indeed have shown that in cystin urines the yield of sulphide with this method may amount to only 30 per cent of the actual quantity present. For this reason we chose the estimation of the neutral sulphur, well knowing that its amount is subject even normally to not inconsiderable variations. The method seemed quite applicable, however, to decide the main point at issue, and served its purpose very well.

SERIES I.

The subject of the first series of investigations was C. S., male, æt. 43, a case of arthritis deformans. The case was a light one with nothing of interest in his history. There was some stiffness of the back and neck; the right knee was somewhat swollen, but beyond that there were no abnormalities of moment. From our standpoint the individual could be regarded as normal. His diet during the entire course of the study was constant (v. s.). At first his normal sulphur elimination was studied during a period of eleven days; the results of the last five days are given in the following table:

TABLE I.

Date.	Amount of Urine.	Sp. Gr.	Total S, as S.	Oxidized S, as S.	Neutral S, as S.	% of N. S. as compared with total S. (total = 100).
III						
13/14	900 cc.	1.021	0.7304	0.6883	0.0421	7.8%
14/15	1150 cc.	1.017	0.7072	0.6900	0.0172	2.4%
15/16	1120 cc.	1.017	0.7402	0.6598	0.0804	10.6%
16/17	830 cc.	1.020	0.7182	0.6793	0.0389	5.4%
17/18	1070 cc.	1.018	0.7806	0.6265	0.1541	19.7%
Average			0.7353	0.6687	0.0665	9.18%

The figure 9.18 for the neutral sulphur is rather lower than is commonly given. The values obtained by Salkowski,[23] Lepine and Flavard,[24] and Stadthagen[25] vary between 13 and 16.8. The number of analyses which form the bases of these averages, however, are rather small, and it is quite likely that in non-cystinuric individuals even the variations in the excretion of the neutral sulphur are more extensive than is commonly thought. Mester[26] found 18.1 per cent as average of his estimations in nine individuals, the figures varying between 12.3 and 30.6 (!).

The marked variations of the neutral sulphur from day to day are on first consideration rather surprising, but quite analogous to the variations in the bile sulphur, to which Stadelmann[27] already drew attention, and which are also well shown in v. Bergmann's series (0.028-0.062, absolute values). These variations then must be borne in mind in interpreting the results which are observed in feeding studies, such as ours.

On March 18 the individual now received 1 grm. of cystin, corresponding to 0.265 grm. of sulphur; this was administered in divided doses, viz.: 0.25 grm. at 9 and 12 A. M. and 3 and 6 P. M. The daily collection of urine began at 7 A. M. He thus received the entire gramme of cystin within the first twelve hours of the twenty-four. The next day no cystin was given. The day following he received 1.5 grm. of cystin (= 0.397 grm. S.), likewise in divided doses of 0.25 grm. each (at 9 and 11 A. M. and at 1, 3, 5 and 7 P. M.); this was followed by two normal days. The results are shown in Table II, and represent a direct continuation of the series of Table I.

It may be mentioned at this place that the cystin in the doses which we employed (1 and 1.5 grammes) produced no untoward results whatever. That large amounts could not be given with safety was suggested by Blum's experience, whose first dog was found dead within thirty-six hours following the administration of 9.6 grms., death being due to a hemorrhagic nephritis. This dose, considering the weight of the animal, viz., 9 kgrs., was of course excessive. In the second experiment, in which 4.5 grms. were fed to a dog of approximately the same weight, the animal was somewhat languid, but showed no other ill effects.

TABLE II.

Date.	Amount. of Urine.	Sp. Gr.	Total S, as S.	Oxidized S, as S.	Neutral S, as S.	% of N. S, as compared with the total S.	Remarks.
18/19	920	1.021	0.6886	0.6638	0.0248	12.2%	1.0 cystu
19/20	1250	1.016	0.8876	0.8204	0.0672	7.5%	
20/21	1000	1.018	0.7771	0.6988	0.0783	10.0%	1.5 cystin
21/22	1460	1.016	1.0146	0.9496	0.0650	6.5%	
22/23	830	1.020	0.6609	0.5911	0.0698	10.5%	

A study of the above figures shows that in the twenty-four hours, during which the one gramme of cystin was given, there was no evidence whatever of an increased sulphur output; the amount of total sulphur indeed was lower than the minimum of the five normal days. Possibly this is in part accounted for by the fact that on the day preceding there was the maximal output of the normal period.

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[20] Abderhalden, E.: Zeit. f. phys. Chem., 1903, vol. XXXVIII, p. 559.

[21] Mester: l. c., p. 117.

[22] Baumann and Goldmann: Zeit. f. phys. Chem., 1888, vol. XII, p. 254.

[23] Salkowski: Virchow's Archiv, vol. LVII, p. 501.

[24] Lepine and Flavard: Rev. d. Med., 1881, p. 27.

[25] Stadthagen: Virchow's Arch., vol. C, p. 424.

[26] Mester: Zeit. f. phys. Chem., 1890, vol. XIV, p. 136.

[27] Stadelmann, E.: Der Icterus, Stuttgart, 1891.

The following day values were obtained, which both in the case of the total and oxidized sulphur are well beyond the maximal normal figures. The neutral sulphur at the same time was not increased beyond the average normal. Manifestly the increase is very largely in the oxidized sulphur. As compared with the average normal it amounts to 0.1517 grm. That this plus is referable to the ingested cystin cannot be doubted. Whether or not the increase of the neutral sulphur over the previous day is also due to the cystin is difficult to say, but does not seem improbable. If so, we would have would still be a deficit of 0.17 grm., which can probably only be accounted for by assuming that a portion of this, at any rate, was either retained in the body or eliminated through some other channel. The data obtained on the next day suggest the former possibility as quite likely, for we find that the value of the oxidized sulphur is still somewhat above the maximal normal value, and that the non-oxidized sulphur is even a little higher than on the previous day. On this day cystin had again been given, but as we have seen the elimination of its sulphur apparently does not occur on the same day, and we can accordingly refer the slightly higher value to the first feeding. The following day the oxidized sulphur is very high; 0.397 grms. of cystin sulphur had been given and we find 0.2809 grm. above the average. The balance is not accounted for, as the neutral sulphur was not increased even beyond the previous day, and as on the following day abnormally small sulphur values are found, lower in fact than on any preceding day.

From these analyses we can conclude that under normal conditions in man, as in the dog, the administration of cystin by the mouth leads to an increased elimination of the oxidized sulphur; that by far the greater portion of the ingested sulphur is thus eliminated; that a comparatively insignificant fraction may appear in non-oxidized form, though the evidence in this regard is not conclusive; and that a portion of the cystin sulphur is either retained or eliminated through other channels.

v. Bergmann has shown that there is evidence of a retention of sulphur even normally, for on feeding cholalic acid to dogs he could demonstrate that the amount of bile sulphur is at once increased, whereas the administration of cystin *per se* is without effect.

The question now arising was: What will happen if at this stage cholalic acid is given? The result is seen in the first row of analyses of Table III. This test was followed at once by one in which the patient received 1.5 grm. of cholalic acid and 1.5 grm. of cystin on the same day, both given simultaneously in divided doses of 0.25 grm. each, every hour. On this day the administration began at 12 M. and was continued until 5 P. M. Then follow two days in which neither cystin nor cholalic acid was given, and after this a repetition of the test, with this difference, however, that the cystin and cholalic acid were not given simultaneously.[28]

The results are seen in Table III.

TABLE III.

Date.	Am't	Sp. Gr.	Total S, as S.	Oxid. S, as S.	Neutral S, as S.	% of N. S, as compared with the total S.	Remarks.
23/24	870	1.018	0.5811	0.5710	0.0101	1.7%	1 grm. sod. cholate.
24/25	1000	1.017	0.6380	0.5795	0.0585	5.1%	1.5 grm. cystin and 1.5 grm. sod. cholate.
25/26	1450	1.015	0.8949	0.8265	0.0684	7.6%	
27/28[29]	1250	1.018	0.9370	0.8396	0.0974	10.3%	1 grm. cystin A. M. and 1.5 grm. sod. cholate P. M.
28/29	750	1.023	0.6310	0.5942	0.0368	5.8%	1 grm. cystin and 1.7 grm. sod. cholate.
29/30	1000	1.017	0.8026	0.7304	0.0722	8.9%	

A comparison of the first row of figures with the results obtained on the preceding day, shows that there has been a still further drop of the oxidized sulphur and that the neutral sulphur has fallen to 1.7 per cent of the total—the lowest figures in the entire series. This result finds its logical explanation in v. Bergmann's analogous examination, in which the bile-sulphur elimination was studied (v. s.). Our investigation thus forms the counterpart to that of v. Bergmann and supplements it. It supports the assumption that even normally there is a retention of neutral sulphur in the body, which is eliminated, in part at least, as taurocholic acid, providing that a sufficient amount of cholalic acid is available.

The studies with cystin and cholalic acid, which now follow, were undertaken for the purpose of ascertaining to what extent the cholalic acid is capable of preventing the complete oxidation of the administered cystin. In the first test, as indicated above, the cystin and cholalic acid were given simultaneously. As the cystin sulphur elimination had previously occurred, not in the same, but in the second twenty-four hours, while the excretion of the cholalic acid takes place earlier, there was a possibility that the effect would be essentially the same as if cystin had been fed alone. The result is very interesting. We find that during the first twenty-four hours the elimination of the oxidized sulphur is practically the same as on the previous day, and that the neutral sulphur is still below the average normal, although it has risen somewhat. On the 26th the neutral sulphur was still normal, but the oxidized sulphur had now risen to 0.8265, as compared with 0.6687, the average of the normal days. We thus find that there has been a gain of 0.1578 grm., while in the corresponding previous test with the same amount of cystin given alone 0.2809 was eliminated above the average normal. As 1.5 grm. of cystin contain 0.39 grm. of sulphur, there must either have been a considerable retention, or an elimination through other channels. v. Bergmann's feeding experiments with cystin and cholalic acid in dogs, to which reference has repeatedly been made, can scarcely leave any doubt regarding the fate of the excess of sulphur in this case. That an increase occurred at all may be owing to the fact that too little cholalic acid was given to combine with the entire quantity of cystin to form taurocholic acid, or that the cholalic acid had not been given at the right time. To investigate this possibility the next examination was so modified that the man only received 1 gramme of cystin, which was given in doses of 0.25 grm. at 8, 9, 10 and 11 A. M., while no cholalic acid was administered until 7 P. M. From this time until the following morning at 7 he was given 1.5 grm., viz.: 0.5 at 7 P. M., 0.25 at 8 and 9 P. M., and 0.5 at midnight. It was hoped that in this manner it would be possible to cause the elimination of a considerable amount of cystin sulphur through the bile, and that correspondingly low values would be found in the urine. The result, however, was different. For we find that the oxidized sulphur had risen 0.1709 grm. beyond the average, and that the neutral sulphur also was somewhat higher than usual, viz., 0.030 grm. In other words, 0.20 grm. of the 0.26 grm. of cystin sulphur had reappeared in the urine, and as usual largely in completely oxidized form. The reason of the appearance of the cystin sulphur in the urine of the same twenty-four hours within which it was fed was this time probably due to the fact that it was all given within the first four hours of that day.

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[28] Cholalic acid, as such (viz. as sodium cholate) is in man as in dogs, borne without any ill effects.

[29] The urine from the 26th to the 27th was unfortunately thrown away.

In the next examination, which was unfortunately, but of necessity, the last in the present case, 1 grm. of cystin was given in two doses of 0.5 grm. each, at 2 and 3 P. M. The administration of cholalic acid began at 5 P. M. From that time off the man received 1.72 grm. until midnight. The result is the following: Within the same twenty-four hours no increased amount of sulphur was eliminated in the urine, either in oxidized or non-oxidized form. On the contrary, the values are rather lower than normal. The following day the oxidized sulphur has increased to 0.7304 and the neutral to 0.0722. If we refer the total increase over the previous day to the administered cystin, we find that 0.17 grm. of the cystin sulphur has appeared in the urine, viz., 65.3 per cent, so that we may assume that 35 per cent approximately was eliminated through other channels. This value, we believe, is really a minimal value. Comparison with the average amount of oxidized sulphur for the normal period would give a much higher figure. The fairest conclusion probably would be based on a comparison of our normal values as one group, with the second series embracing the feeding tests with cystin alone, and the third in which cystin and cholalic acid were fed together. Such an analysis would show the following:

During the cystin days (18/19-22/23 incl.) 4.0288 grms. of sulphur were eliminated in the urine. During the same period 5 times 0.7353 (average amount of total sulphur), plus 0.26 plus 0.39 grm. of cystin sulphur, *i. e.,* 4.3265 grms. in all, should have been eliminated, if all the cystin sulphur had been excreted through this channel. We find a deficit of 0.2977 grm. which must have been removed in some other manner. A similar calculation will show that during the cystin cholalic acid period only 4.4846 instead of 5.3218 appeared in the urine, *i. e.,* there is a deficit of 0.8372 as compared with 0.2977 of the cystin period alone. This represents 91.2 per cent of the entire amount of cystin sulphur which has been fed during this period. There can thus be no doubt that the administration of cholalic acid will normally prevent the oxidation of a not inconsiderable amount of cystin sulphur to urinary sulphates, and we thus see again that our experimental results directly confirm those reached by v. Bergmann, who noted a corresponding increase of the bile sulphur in his feeding experiments in dogs. Whether or not it would be possible to prevent the oxidation of ingested cystin to urinary sulphates altogether by the administration of larger amounts of cholalic acid remains to be determined. To do so in the human being did not seem justifiable. That it is essential in such investigations to consider the time relation in the administration of the one in reference to the other is clearly demonstrated by our experiments.

To sum up, we believe we have shown:

1. That in the human being the administration of cystin by the mouth does not lead to a material increase in the elimination of the neutral sulphur, but that 53 per cent approximately appears in completely oxidized form.
2. That a portion of the ingested cystin is eliminated through other channels.
3. That the administration of cholalic acid *per se* causes a moderate decrease in the amount of urinary sulphur, which largely affects the neutral sulphur.
4. That the administration of cholalic acid will prevent the oxidation to urinary sulphur of a very considerable portion of cystin administered at the same time.

In view of v. Bergmann's experiments and our own studies, we conclude that a certain amount of the cystin liberated during the normal metabolism of the body is eliminated in the bile in combination with cholalic acid as taurocholic acid, while the remainder appears in the urine in completely oxidized form.

With these data given, it seemed of interest to ascertain in what manner the *cystinuric* individual would react to the administration of cholalic acid. The results follow in the second series of investigations.

SERIES II.

The cystinuric individual was a man, æt. 42, who entered the hospital for purposes of study only. He was not ill at the time, barring some pain in the back, from which he had suffered more or less for a number of years. This pain bears the character of lumbago. A definite history of renal calculus cannot be made out. Early in January of the present year he spoke of having had very severe pain in the region of the kidneys on both sides. At the time he had influenza. He has never passed blood or gravel. He is a large eater and a fairly steady drinker. His weight is usually about 183-185. There is distinct arterial thickening, but beyond this physical examination reveals nothing of note.

The cystin was discovered in the man's urine in July, 1899, when he first came under observation at the Johns Hopkins Hospital, suffering from an attack of febricula. His case is briefly referred to in the collective report on cystinuria by one of us, which was published in January, 1900.[30] At that time Dr. Amberg examined the man's urine for diamins with negative result. From the feces a small amount of a benzoylated product could be obtained, which was not sufficient, however, for identification. An examination of the urine of the man's children was negative for cystin, but in one a marked sulphur reaction was obtained.

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[30] Simon, C. E.: Cystinuria and its Relation to Diaminuria, Amer. Journ. Med. Sci., Jan., 1900, p. 39.

Several examinations of the man's urine have been made since that time. Cystin could always be demonstrated microscopically and separates out spontaneously without the addition of acetic acid. The amount was variable and at times very large. In the urine of the children we also could not demonstrate any cystin, but we noted the marked sulphur reaction, which Dr. Amberg had observed in one of the boys. An examination for diamins, in which ten liters of urine were benzoylated, proved negative; a single fecal examination in the same direction also led to no positive result.

The man's diet, while under observation in connection with the present series of examinations, was constant (see above). During the first three days no cholalic acid was given. On the 28th he received 0.6 grm. in divided doses of 0.1 grm. each, one capsule every two hours; the following day 0.9 grm. was given, and on the next 1.5. Then follow three control days, and after this 5 days on each of which the man received 2.0 grms., in divided doses distributed over the hours from 8 A. M. to 8 P. M. Aside from the bitter taste no unpleasant results were noted. The patient consumed a large amount of water during the entire course of the investigation, and passed correspondingly large amounts of urine (see Table IV). As cause of his thirst he mentioned the bitter taste of the sodium cholate. But as the figures in the table show, the polyuria existed already before the administration of the cholate began and continued during the control days. Possibly the withdrawal of his beer may be of moment.

Unfortunately, we have only one day of satisfactory analyses for the three-day period preceding the administration of the sodium cholate; these were obtained on the second day. The urine of the first day was thrown away, and on the third day other analyses showed conclusively that the collected amount did not represent the entire output of the twenty-four hours. The fact that we only had the single set of analyses for this period seemed at first a serious deficiency, but, as will be seen, the cholalic acid was absolutely without effect upon the sulphur metabolism of our individual, so that we did not deem it necessary to extend the study of "normal" days at that time.[31] The results follow:

TABLE IV.

Date. I.	Amount.	Sp. Gr.	Total S, as S.	Oxid. S, as S.	Neutral S, as S.	% of N. S. compared with total S. (total = 100).	Remarks.
'04							
25/26	Lost						
26/27	2290	1.015	0.9250	0.6703	0.2547	27.4	
27/28	Incomplete collection					24.8	
28/29	2500	1.012	0.5942	0.5248	0.0694	11.6	0.6 Sod. cholate
29/30	1700	1.012	0.5411	0.4260	0.1151	21.2	0.9 " "
30/31	3480	1.009	0.9102	0.5300	0.3802	41.7	1.5 " "
31/1	3450	1.007	0.7142	0.4258	0.2884	40.3	

Date. II.	Amount.	Sp.Gr.	Total. S, as S.	Oxid. S, as S.	Neutral S, as S.	% of N. S. compared with total S. (total = 100).	Remarks.
1/2	3480	1.008	1.0033	0.3896	0.6137	61.1	
2/3	3245	1.008	0.7062	0.5906	0.1156	16.3	
3/4	3250	1.008	0.6358	0.6059	0.0299	4.7	2.0 Sod. cholate
4/5	3400	1.008	0.5850	0.3668	0.2182	36.9	2.0 " "
5/6	4720	1.006	0.5563	0.3596	0.1967	35.4	2.0 " "
6/7	3500	1.006	0.6771	0.5807	0.0964	14.2	2.0 " "
7/8	4970	1.007	0.8112	0.5417	0.2697	32.9	2.0 " "

The most striking feature of this table is the inconstancy of the results from day to day. On the 27th we find 0.6703 grm. of oxidized sulphur. This corresponds quite closely to our average normal value in the first case. On the 29th there is a drop to 0.5248, which coincides in point of time with the administration of the 0.6 grm. of cholalic acid. The next day there is a further drop to 0.426, which might be referred to the continued administration of cholalic acid. As the neutral sulphur on the day before had fallen to normal, the inference suggested itself that the cystinuria might actually be associated with, even if not dependent upon, an insufficient production of cholalic acid. On the 31st, however, we find that in spite of the still continued administration of cholalic acid in increased amount there is an abrupt ascent of the neutral sulphur to 0.3802, *i. e.,* to a higher value than was noted on the normal day (the 26th). The lower oxidized sulphur values during these days, as compared with the "normal" day, thus do not indicate as in our control individual that the difference in amount is eliminated through other channels. With the exception of the 28th, the neutral sulphur goes up as the oxidized sulphur goes down, and vice versa.

During the three normal days which follow the three cholalic acid days the neutral sulphur fluctuates between 16.3 and 61.1 per cent of the total sulphur. Then follows the second cholalic acid period, in which the man received 2.0 grms. daily. The results on the 4th again suggest an effect on the part of the cholalic acid analogous to what occurs in the normal individual, but the values which follow are so variable as to render the conclusion that the cystinuria is the outcome of an insufficient production of cholalic acid, quite improbable.

The fluctuations in the sulphur elimination which we noted in our case seem at first quite surprising, but are after all perfectly analogous to what occurs in the bile. Stadelmann already noted the great variations in the daily elimination of all the constituents of the bile, and in v. Bergmann's series the normal sulphur values varied between 0.028 and 0.062 grm. That these fluctuations are the expression of a temporary retention alternating with periods of increased elimination can scarcely be doubted. We have seen evidence of this in our normal individual.

Our studies thus show that while the administration of cholalic acid in the non-cystinuric individual leads to a diminished elimination of the sulphur in the urine, this does not occur in the cystin subject. This would suggest that in the cystinuric individual taurocholic acid is possibly not formed at all, in which case we would be forced to assume either that all the sulphur liberated in the body is eliminated in the urine, or that a portion is excreted in the bile in a form different from taurocholic acid.

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[31] On a subsequent occasion the percentage neutral sulphur values, as compared with the total sulphur on three consecutive days were 29.2, 29.4 and 35.6. The absolute figures were 0.2367, 0.1517 and 0.1774 grm. S.

Unfortunately there are no analyses of the bile of cystinuric individuals available to determine this point. To draw inferences from a comparison of average total sulphur values in the urine of the cystinuric as compared with the non-cystinuric individual would be hazardous, owing to the fact that in man the elimination of sulphur in the bile is rather low. Taking 0.39 per cent of sulphur, given by Pfaff and Balch,[32] as an average value for dried human bile, and 8.57 grms. as an average amount of solids, this would correspond to 0.0334 grm. of sulphur eliminated in the bile in twenty-four hours. This figure is manifestly too low to warrant a comparison of average total sulphur values in the case of the urine. From the fact, however, that in man the amount of biliary sulphur is so small, *we may be warranted in assuming that the elimination of the katabolized sulphur through this channel is of secondary importance only, and that accordingly the presence of more or less cholalic acid (within normal limits) would not materially affect the elimination of cystin in the cystinuric, even if the union between the two were possible, which, according to our studies, is not the case. The presence or absence of cholalic acid, hence, does not enter into consideration in connection with the chemical mechanism which is at work in the production of cystinuria.*

We have shown that so far as the formation of taurocholic acid is concerned two views are possible. Either that the cystin is first oxidized to taurin and that this then combines with cholalic acid, or that the cystin unites with cholalic acid directly and that the resulting product is then oxidized to taurocholic acid. As the formation of cholalic acid is only known to occur in the liver, the cystin in the second case would under ordinary conditions have to reach that organ as such, and we should accordingly expect that it would be possible to demonstrate the presence of cystin in the blood. This, however, has never been accomplished. If we accept the first possibility, on the other hand, we may imagine that the primary oxidation occurs already in the tissues at large where the liberation of cystin takes place. In this case we should expect to find evidence of such primary oxidation in the presence of taurin, for example, outside of the liver. As a matter of fact, taurin has been found in the lungs, the kidneys, the muscle tissue, in the spleen, in the adrenal glands, etc., of various animals.

That a transformation of this order would be effected by intracellular enzymes can scarcely be doubted. Direct experiments with the various tissues at large have thus far only been made in the case of the liver by Blum,[33] who records that on mixing cystin with defibrinated blood and finely hashed liver, and allowing the mixture to stand for seven hours at 37° C., no taurin was obtained. Blum's experiment we do not regard as conclusive, however, as ordinary mechanical comminution may not suffice to liberate the intracellular ferments which would be concerned in the oxidation of cystin to taurin with the coincident loss of carbon dioxide. More detailed experiments in this direction are now under way in Dr. Simon's laboratory, and upon these we expect to report on a future occasion.

In conclusion, we wish to express our indebtedness to Dr. Wm. Osler for the kind interest which he has taken in our work and the facilities which he has placed at our disposal.

In my previous papers on cystinuria (Amer. Journ. Med. Sci., 1900, Vol. CXIX, p. 39, and *ibid.*, Vol. CXXIII, p. 838, the last in association with Dr. W. M. Lewis), I have given references to 112 cases. Since that time I have found records of additional cases as follows: Gamgee, A case of cystinuria with formation of calculi, Lancet, 1901, I, p. 470. Percival, A., Un caso di cistinuria, Clin. Med. Ital., 1902, Vol. XLI, p. 50. Gilbert, G. A., Report of a case of cystinuria, Chicago Clin., 1900, Vol. XIII, p. 177. Abderhalden, E., Familiäre Cystindiathese, Zeit. f. Phys. Chem., 1903, Vol. XXXVIII, p. 557 (five cases). Riegler, Ein interessanter Fall von Cystinurie und Cystinsteinen, Wien. Med. Blätter, 1904, No. 3 (Ref. Biochem. Centralbl., 1904, Vol. II, p. 373). Schölberg, H. A., and Garrod, A. E., Ein Fall von Cystinurie mit Diaminurie, Lancet, 1901, II, p. 526, previously reported by Sadler, *ibid.*, 1901, I, p. 470. One of the cases previously referred to by Garrod in a note to me has since been published by Cammidge, P. J., Cadaverin im Harne in einem Fall v. Cystinurie, Lancet, 1901, II, p. 592. In addition, Dr. Garrod has kindly drawn my attention to the following cases in the earlier British literature: Bence Jones, Trans. Pathol. Soc., 1848-50, Vol. II, p. 237. Risdon Bennett, *ibid.*, 1850-2, Vol. III, p. 383. Church, W. S., *ibid.*, 1869, Vol. XX, p. 240. Sir Henry Thompson, *ibid.*, 1870, Vol. XXI, p. 272. C. Heath, *ibid.*, 1876, Vol. XXVII, p. 360, and XXIX, p. 154. Shattock, S. G., *ibid.*, 1879-80, Vol. XXXI, p. 182. Ord, W. M., *ibid.*, p. 384. Bowlby, A. A., *ibid.*, Vol. XL, p. 182, and Jacobson, Trans. Clin. Soc., 1891, Vol. XXIV, p. 170. Adding these 19 cases to the 112 previously collected, there are now 131 of which notes exist in the literature.

S.

NOTES ON NEW BOOKS.

Elements de pathologie et de clinique chirurgicales. By Dr. Leon Moynac (de Bayonne). Eighth edition, three volumes. Illustrated by 134 engravings. *(Paris: G. Steinheil, 1903.)*

The fact that a book has reached its eighth edition is certainly evidence of a continued demand for its publication, although we do not feel sure that it is, as the writer claims in his preface, a guarantee of its established usefulness. The arrangement of subject matter in the three volumes is very suitable, the first volume being devoted to the surgery of the tissues; the second to that of the brain, the trunk, and the limbs; the third to special surgery.

A large part of the first volume is occupied with fractures, dislocations, and bone lesions, all of which are quite fully discussed; but these subjects suffer especially from a defect which detracts from the value of the book throughout, namely, a paucity of illustrations. The whole number of these (324) is insufficient for a work of such scope; moreover, they are of small size, and not very clearly printed.

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[32] Pfaff, F. and Balch, A. W.: Journ. Exper. Med., 1897, vol. II, p. 49.

[33] L. c.

Abdominal surgery, which is considered in the second volume, receives but scant attention, when the extent of its present boundaries is remembered. The subject of appendicitis especially is very cursorily considered, and to American ideas seems much behind the time. Operation, we are told, is indicated only upon the appearance of a tumor, and but one method of incision and removal is given, these being disposed of in less than a dozen lines. We are somewhat surprised to learn that in America the routine treatment of appendicitis, in the absence of operation, is purgation. Abscess in the right iliac fossa is separately considered, although the writer admits that the large majority of such cases originate in the appendix vermiformis.

Surgical affections of the mammary-gland also are very briefly dismissed, only twenty-five pages being devoted to a class of diseases so important and so frequent. Hernia, on the contrary, is considered very fully, the radical treatment of it being warmly advocated.

In these days of specialization and collaboration it strikes us as strange that the highly individual subjects considered in the third volume should be treated by one person, and he the same one who has already treated general surgery. Ophthalmology, otology, and gynecology are generally considered to be the province of their own highly trained specialists, but in this case no assistance has, apparently, been sought in their treatment. No names are mentioned as contributors, and the author makes no acknowledgments, except a few words of thanks in the preface to Mm. Hartmann and Terrier for permission to copy illustrations from their works.

A good many things are well said, and the book is to be commended in that the author never loses sight of the simplicity of style and expression suited to its declared purpose, namely, that of a text-book for students, rather than a reference book for practitioners. As a whole, however, it fails to inspire entire confidence, largely, perhaps, because the treatment of so many and such diverse subjects by one individual cannot but excite a suspicion of inadequacy in some of them. It has the advantage of being well indexed, having both a table of contents for chapters, and an alphabetical index of subjects.

A Surgical Hand-book for the use of Students, Practitioners, House-Surgeons and Dressers. By Francis M. Caird, M. B., F. R. C. S. (Ed.), and Charles W. Cathcart, M. B., F. R. C. S. (Eng. and Ed.). Twelfth edition with numerous illustrations. *(London: Charles Griffin and Co., Limited; and Chicago: W. T. Keener and Co., 1903.)*

This is a useful little work in which the whole duty of a surgeon is compressed into a volume of such small size that it can be carried in the pocket for constant reference. Nothing is more difficult than to carry compression to such an extent without sacrificing completeness of subject matter or clearness of style. The authors are to be congratulated that they have succeeded well in their present attempt. The illustrations, although small are suitable, and the print is much better than could be expected when it is necessarily so minute.

The Therapeutics of Mineral Springs and Climates. By I. Burney Yeo, M. D., F. R. C. P. *(Chicago: W. T. Keener and Co., 1904.)*

This work is the third of a series covering the entire field of therapeutics. It is a subject, which has long engaged the writer's attention, and he considers it very thoroughly. The first part of the work, which is devoted to Mineral Springs, classifies them according to the nature of their waters, and then describes the countries which belong under each class. It then proceeds to consider the action, both external and internal, of each class, and finally to discuss the chief springs individually. The second part of the work is concerned with climates, and is arranged under the same general plan.

We have sketched the whole book in outline, because its value to those who need it lies in the extent of information it contains. That this information can be relied upon is guaranteed by the author's reputation. The work is very thoroughly done, and contains many items of interest, and often of service outside of the beaten track, to the invalid condemned to expatriation. We do not need the author's assurance that it represents care and pains in the preparation, for it carries within itself the assurance of both, and we are indebted to him for a fund of reliable information, not only upon the main points at issue, but upon many of the minutiae, a knowledge of which smooths the path of the tourist in search of health.

Mammalian Anatomy with special reference to the Cat. By Alvin Davidson, Ph. D., ex-fellow of Princeton University; Professor of Biology in Lafayette College. With over 100 illustrations made by W. H. Reese from the author's dissections. *(Philadelphia: P. Blakiston's Son and Co., 1903.)*

The principle of this work is that enunciated by Huxley, namely, that it is wiser for a student to begin with the study of vertebrate rather than invertebrate anatomy. The structure of the cat to which the book is devoted, is intended to illustrate the broad outlines of the more important morphologic structures of the Mammalia. It has the defect common to all anatomical text-books of devoting too large space to the skeleton, but the remaining divisions are well adjusted. The descriptions are clear and the illustrations well chosen.

Transactions of the Medical Association of Georgia. Fifty-fourth Annual Session, 1903. *(Atlanta, Ga.: The Franklin Printing and Publishing Co., 1903.)*

A number of papers of greater or less excellence are here brought before the public in excellent form, the paper, type, binding, etc., being well chosen and executed.

One excellent article is by Floyd Willcox McRae, of Atlanta, on "The sin of so-called conservative treatment in diseases requiring prompt surgical intervention." It is a subject of great importance, besides being one which often escapes attention, especially in rural districts. Strangulated hernia and fulminating appendicitis are the two conditions discussed in detail, with force and effect, and the discussion at the close showed his hearers appreciative.

The use of large doses of strychnia in ileus is strongly advocated by R. M. Harbin, of Rome, with the idea that it secures the one great end, namely, the regulation of the bowels without the difficulties incident to other methods.

The vaginal route in gynecology finds a strong advocate in George R. White, of Savannah, who has apparently gone closely into his subject and gives a complete bibliography of it.

A sensible paper by Ralph M. Thomson, of Savannah, on "Criminal Kindness," shows clearly and justly that the indiscriminate feeding of infants should be classed under this head. We cannot quite agree with him, however, that the cheapness of the food eaten by the children of the poor ensures corresponding simplicity and wholesomeness of diet. That it necessarily excludes certain costly dainties is true, but coarseness, lack of variety, and adulteration are counter-balancing evils.

Another useful paper is one by John C. McAfee, of Macon, on "An operation for permanent and quick cure of hemorrhoids, almost bloodless and painless." The writer says that "an anodyne is frequently not needed after the operation and patients invariably tell me that they feel better the day after the operation than the day before." Such testimony is of considerable value, when we consider the exquisite suffering which patients are forced to endure at present after the removal of hemorrhoids.

A Practical Treatise on Genito-Urinary and Venereal Diseases and Syphilis. By Robert W. Taylor, A. M., M. D. (*New York and Philadelphia: Lea Brothers and Co., 1904.*)

This volume is an old friend in new garb, being the third edition of a work which has already taken a place—and a creditable place—in American medical literature. The rapid exhaustion of the large second edition proves that the book has shown itself a satisfactory and trustworthy guide for practitioners and students of medicine and invalidates empirically the doubt which obtrudes as to the need of a new volume in this somewhat restricted field of surgery. Taylor's book certainly stands in the first rank of American text books of Genito-Urinary Surgery—along with Keyes, White and Martin and possibly one or two others. It compares favorably, too, with Casper, indeed, for student purposes, is probably superior to it. But, though all of these works are good, none is excellent and that adjective is certainly extravagant in reference to the volume before us. The conventional material for works of this sort—gonorrhea in all its aspects, stricture, syphilis, etc., is fully, lucidly and usefully treated and the text is richly illustrated by pictures, the majority of which are to be commended for their excellence. A few are particularly good; while several, notably some of the microscopical drawings and a view of a carcinomatous penis, are particularly bad. Dr. Taylor has included in his book, logically we think, the venereal affections of female genital organs and the work is, from the venereal side, a complete one. Two hundred and seventy of the seven hundred odd pages are devoted to syphilis and our author has therefore made genito-urinarian and syphilographer roughly synonymous. This, however, is somewhat contrary to the custom which obtains. Genital and urinary surgery is constantly being more and more emphasized, while genital medicine, so far from forming the main and essential material for genito-urinarians, is being largely shared with dermatologists and clinicians. Text books of genito-urinary surgery have even gone so far as practically to omit all mention of syphilis; and while it would be absurd to insist on the relegation of this protean malady to any one department of medicine, it does seem as though its constant association with and inclusion in genito-urinary surgery ought to have some more logical basis than the frequent occurrence of the initial lesion on the genitals.

Genital surgery has received less complete and less intelligent treatment in the volume before us than genital medicine. We turn for instance instinctively to one of the live surgical subjects and we find prostatic hypertrophy rather scantly considered. A catheter life is strongly advised as long as it is possible or "wise." The perineal operation is dismissed with a small paragraph and no procedure is mentioned but that of Alexander. Suprapubic prostatectomy is said to be the operation of choice in the great majority of cases demanding operative relief, "as the overgrowth can be inspected, hemorrhage readily controlled, and calculi removed without adding any risk to the operation,"—hardly convincing reasons for the preference to perineal prostatectomy to which they equally apply.

One cannot escape the impression that Dr. Taylor has failed to bring to this work the intimate and extensive acquaintance with the recent literature of the subject which is essential to a really first rate text book. We find extravasation of urine, for instance, regarded as always following urethral rupture and no mention made of Albarran's "urinary edema of septic origin," or of Motz's convincing study of the subject with his conclusion as to the inaptness of the conventional term for the condition.

A Text-book of Physiology. By Isaac Ott, A. M., M. D. Professor of Physiology in the Medico-Chirurgical College of Philadelphia. With 137 Illustrations. Royal Octavo, 563 pages. (*Philadelphia, Pa.: F. A. Davis Company, Publishers.*)

The scope of Professor Ott's work may be judged of by the following extract from the author's preface: "This book has been written at the solicitation of students who have attended my lectures for the past eight years. The aim has not been to write a treatise on the subject but rather an elementary work containing the chief facts of physiology which are necessary to the student who wishes to apply them in the practice of his profession."

Perusal of the work has given to the reviewer an impression which the preface might lead one to expect. The subject-matter is subdivided and handled just as in most of the text-books of physiology of to-day. Perhaps the only distinctive feature is its brevity. Excepting certain sections, *e. g.*, electrophysiology, brevity has been obtained by omission of explanations rather than by the ommission of facts—by empiricism rather than by judicious elimination of all but important topics. This brevity coupled with only too frequent inexact and awkward diction, cannot fail to limit the value of the book from the student's standpoint.

However, the work demonstrates that the author is thoroughly familiar with all of the old and new contributions to the subject of physiology and furthermore that he has at his command a valuable fund of interesting collateral data. And we should not lose sight of the fact that the book has been written at the solicitation of *his* students and therefore in all probability, for his students. The reviewer believes that the work will prove of very great value to the author's students when used by them to supplement the author's lectures.

Manual of Materia Medica and Pharmacy. Specially designed for the use of Practitioners and Medical, Pharmaceutical, Dental and Veterinary Students. By E. Stanton Muir, Ph. G., V. M. D. Instructor in Comparative Materia Medica and Pharmacy in the University of Pennsylvania. Third edition, revised and enlarged. Crown 8vo. 192 pages. (*Philadelphia, Pa.: F. A. Davis Company, Publishers, 1914-16 Cherry Street.*)

This book is of such a character as to be generally useful, but like other books of its kind, the tendency is to condense the subjects too much. It is divided into three parts.

The first part treats of botany or rather of botanical terms, and evidently is intended to explain botanical descriptions to those who have not studied the science. It is the merest outline.

The second part is devoted to drugs and chemicals, the important points of each being well arranged. The arrangement is an alphabetical one. If it were different the book would be of more value to the student.

In the third part which treats of Pharmacy and Pharmaceutical Preparations, some of the descriptions of the classes of Official Preparations are much too brief and misleading to be of use to one not familiar with Pharmacy. For instance, on page 149, under Emulsions, the author says, ". . . . They are prepared by triturating the medicinal agent with the gum or sugar and slowly adding the water . . ." J. L. W.

Golden Rules of Psychiatry. By James Shaw, M. D. *Golden Rule Series, No. V.* (*Bristol: John Wright & Company.*)

This vest pocket volume contains a wonderful amount of information clearly and tersely expressed on the symptoms of mental diseases as they are usually encountered by the general practitioner. While the tabloid system is not to be recommended, when applied to gaining knowledge, to those not familiar with the insane, this is a means of reviewing knowledge previously acquired. From a perusal of it the student will gain a great many points which will be of value in assisting to fix in his memory the knowledge which he gains at lectures and clinics. The author is to be congratulated on having put so much information into such small compass. W. R. D.

A System of Practical Surgery. By PROF. E. VON BERGMANN, PROF. P. VON BRUNS and PROF. J. VON MIKULICZ. Volume III. Translated and edited by WILLIAM T. BULL, M. D., Professor of Surgery, Columbia University, and CARLTON P. FLINT, M. D., Instructor in Minor Surgery, Columbia University, New York. Surgery of the Extremities. (*New York and Philadelphia: Lea Brothers & Company, 1904.*)

This system of surgery is so well known that it seems almost useless to discuss it. For the benefit of those to whom this translation, however, may be new, a brief sketch of the contents may not be uninteresting.

The third volume of this edition is devoted to the Surgery of the Extremities. The anatomical divisions of the parts are made to serve as a basis of classification. Each section is taken up in the same manner. The first section deals with the malformations, injuries and diseases of the shoulder and upper arm. In the same way the elbow and forearm, wrist and hand, hip and thigh, knee and leg, and ankle and foot are treated.

Probably the most interesting section is that upon the hip and thigh. In this part the various bloodless methods of reduction of congenital dislocation of the hip joint are given in so clear and concise a manner that the reader easily grasps the salient points of each method.

The value of the book is enhanced by an extensive bibliography at the end of each section.

The illustrations are numerous and for the most part good. This, however, cannot be said of the X-ray productions. They are few in number and are not as good as one would expect to find in such a work.

The translators, broadly speaking, have followed the text closely. It is a matter of regret, however, that they should have thought it wise to omit several chapters. The work is one that should be in the hands of every surgeon.

A Preliminary Report on a Parasite Found in Persons Suffering from Enlargement of the Spleen in India. LIEUT. S. R. CHRISTOPHERS. Scientific memoirs by the officers of the Medical and Sanitary Departments of the Governments of India. New Series, No. 8. (*Calcutta: Office of the Superintendent of Government Printing, 1904.*)

This monograph of 17 pages is a concise, clearly written report, by the author, of his investigation of the disease with which the so-called Leishman-Donovan bodies have been found associated. The protozoan parasite was first described by D. D. Cunningham in 1885, but escaped any general notice until rediscovered by Leishman in May, 1903, and further described by Donovan in July of the same year. Laveran and Mesnie have named the parasite the Piroplasma donavani—inappropriately the author thinks, as he finds but slight resemblance between it and other members of the genus.

The disease in which the parasite is found prevails in Madras, Calcutta, and other parts of India and is probably identical with the disease known as "*kala azar*" in Assam. It is characterized by (1) great enlargement of the spleen, (2) emaciation, (3) irregular pyrexia uninfluenced by quinine, (4) abdominal symptoms (diarrhea and dysentery), and sometimes by œdema of the feet.

Post-mortem one finds a large, firm, non-pigmented spleen, and as a rule large ulcers in the large intestine, which often perforate leading to death from peritonitis. Except for small hemorrhages in the peritoneum and arachnoid, the other changes are those common to febrile diseases. The parasites are not found in the circulating blood, but in the spleen and liver, and in the large intestine about the ulcers. In these situations they usually are found in macrophages. Red blood cells do not appear to be attacked. The parasite is round or oval in one aspect, somewhat pyriform in the other and is characterized by the presence of two chromatin masses and a vacuolated protoplasm. Sexual forms have not been distinguished. Reproduction takes place by division.

The author describes a modified Romanowsky stain by which he has successfully stained the parasite in section.

Second Report of the Anti-Malarial Operations at Mian Mir, 1901-1903. LIEUT. S. R. CHRISTOPHERS. Scientific Memoirs, etc. New Series, No. 9. (*Calcutta: Office of the Superintendent of Government Printing, 1904.*)

The author reviews the work of Captain James, I. M. S., in 1901 and 1902 and of himself in 1903, in which an endeavor was made to reduce the prevalence of malaria among the troops at Mian Mir by procedures directed against the *anopheles* mosquitoes, of which seven varieties were found. The campaign was carried out along the usual lines of drainage; of clearing of irrigation ditches of vegetation, and of "oiling" the surface of pools and ditches, but did not attain to the success claimed by others. For "in Mian Mir almost complete absence of breeding was ensured to a distance of over half a mile, but adults (*anopheles*) still appeared in large and increasing numbers in the area." The malarial season, however, seemed to be postponed and thereby shortened. The author attributes the failure of the operations to the entrance of mosquitoes from without the area supervised, and is of the opinion that the operations "were not those best adapted to the eventual reduction of malaria," believing "that gradual, but permanent improvement in the health of stations by well-directed reforms, whenever these can be carried out, will in the end yield the best return."

Infant Feeding in its relation to Health and Disease. By LOUIS FISCHER, M. D., Visiting Physician to the Willard Parker and Riverside Hospitals, New York City. Third edition. (*Philadelphia: F. A. Davis Company, 1903.*)

The book has been revised and enlarged until it now appears in its third edition, a volume of 357 pages which include a bibliography and very good index. The anatomy, chemistry and physiology forming the foundation of rational infant feeding find consideration in the early part of the book. While the treatment of these subjects includes all the points recognized as essential, the text is not so full as could be wished and often suggests it is no more than notes the author has made in going through the literature.

The clinical side of the work is not open to this criticism. Practical feeding is thoroughly considered, and well illustrated with cases from the author's own experience.

The book will prove useful to those who have occasion to direct the nourishment of young children.

Clinical Treatises on the Pathology and Therapy of Disorders of Metabolism and Nutrition. By PROF. DR. CARL VON NOORDEN. Authorized American Edition translated under the direction of BOARDMAN REED, M. D., Philadelphia. Part V. Concerning the effects of saline waters (Kissingen, Homberg) on Metabolism. (*New York: E. B. Treat & Co., 1904.*)

An essay of eighty-nine pages bearing close resemblance to a testimonial for Kissingen water, and quite unworthy of the guise of science which it has been given.

BOOKS RECEIVED.

Adolescence. Its Psychology and its Relations to Physiology, Anthropology, Sociology, Sex, Crime, Religion and Education. By G. Stanley Hall, Ph. D., LL. D. Two volumes. 1904. 8vo. D. Appleton and Company, New York.

The Mattison Method in Morphinism. A Modern and Humane Treatment of the Morphine Disease. By J. B. Mattison, M. D. 1920. 12mo. 40 pages. E. B. Treat & Company, New York.

Introduction a l'Étude Clinique et a la Pratique des Accouchements. Par Professeur L. H. Farabeuf et Docteur Henry Varnier. Préface du Professeur A. Pinard. 362 figures. Nouvelle édition revue et corrigée. [1904.] 4to. 477 pages. Georges Steinheil, Paris.

International Clinics. A Quarterly of Illustrated Clinical Lectures and Especially Prepared Original Articles on Treatment, Medicine, Surgery, Neurology, Pediatrics, Obstetrics, Gynecology, Orthopedics, Pathology, Dermatology, Ophthalmology, Otology, Rhinology, Laryngology, Hygiene and Other Topics of Interest to Students and Practitioners. Edited by A. O. J. Kelly, M. D. Volume II. Fourteenth Series, 1904. 8vo. 314 pages. J. B. Lippincott Company, Philadelphia.

A System of Practical Surgery. By Prof. E. von Bergmann, M. D., Prof. P. von Bruns, M. D., and Prof. J. von Mikulicz, M. D. Volume III. Translated and edited by William T. Bull, M. D. and John B. Solley, M. D. *Surgery of the Extremities.* 1904. 8vo. 918 pages. Lea Brothers & Co., New York and Philadelphia.

Golden Rules of Anaesthesia. By R. J. Probyn-Williams, M. D. "Golden Rules" Series, No. XIV. [1904.] 32mo. 67 pages. John Wright & Co., Bristol; Simpkin, Marshall, Hamilton, Kent & Co., Ltd., London.

The Practical Medicine Series of Year Books. Comprising Ten Volumes on the Year's Progress in Medicine and Surgery. Issued monthly under the general editorial charge of Gustavus P. Head, M. D. Volume VI. *General Medicine.* Edited by Frank Billings, M. S., M. D., and J. H. Salisbury, M. D. May, 1904. 12mo. 330 pages. The Year Book Publishers, Chicago.

United States Public Health and Marine Hospital Service. Annual Report of the Surgeon-General, for the fiscal year, 1903. 8vo. 572 pages. 1904. Government Printing Office, Washington.

Röntgen Ray Diagnosis and Therapy. By Carl Beck, M. D. With 322 illustrations in the text. 1904. 8vo. 460 pages. D. Appleton and Company, New York and London.

Intercolonial Medical Congress of Australasia. Transactions of the sixth session held in Hobart, Tasmania, 1902. Published under the direction of the literary committee, by Gregory Sprott, M. D. 1903. 8vo. 480 pages. Hobart, Tasmania.

Medical Diagnosis. Special Diagnosis of Internal Medicine. A Handbook for Physicians and Students. By Dr. Wilhelm v. Leube. Authorized translation from the sixth German edition. Edited, with annotations, by Julius L. Salinger, M. D. With five colored plates and seventy-four illustrations in the text. 1904. 8vo. 1058 pages. D. Appleton and Company, New York and London.

A Text-Book of Operative Surgery. Covering the Surgical Anatomy and Operative Technic Involved in the Operations of General Surgery. By Warren Stone Bickham, Phar. M., M. D. Second edition. With 559 illustrations. 1904. 8vo. 984 pages. W. B. Saunders & Company, Philadelphia, New York, London.

Epilepsy and Its Treatment. By William P. Spratling, M. D. Fully Illustrated. 1904. 8vo. 522 pages. W. B. Saunders & Co., Philadelphia, New York, London.

Modern Ophthalmology. A Practical Treatise on the Anatomy, Physiology and Diseases of the Eye. By James Moores Ball, M. D. With 417 illustrations in the text, and numerous figures on 21 colored plates. 1904. 8vo. 820 pages. F. A. Davis Company, Philadelphia.

Second Catalogue of the Library of the Peabody Institute of the City of Baltimore. Including the additions made since 1882. Part VII. S.-T. 1904. 4to. Baltimore.

Medical and Surgical Report of the Presbyterian Hospital in the City of New York. Volume VI. January, 1904. Edited by Andrew J. McCosh, M. D., W. Gilman Thompson, M. D. 1904. 8vo. 331 pages. Trow Directory, New York.

The Clinical Study of Blood-Pressure. A Guide to the Use of the Sphygmomanometer in Medical, Surgical, and Obstetrical Practice, with a Summary of the Experimental and Clinical Facts Relating to Blood-Pressure in Health and Disease. By Theodore C. Janeway, M. D. Seventy-five illustrations in in the text, many in colors. 1904. 8vo. 300 pages. D. Appleton and Company, New York and London.

An Introduction to Vertebrate Embryology. Based on the Study of the Frog and the Chick. By Albert Moore Reese, Ph. D. (Johns Hopkins). With 84 illustrations. 1904. 12mo. 291 pages. G. P. Putnam's Sons, New York and London.

Obstetric and Gynecologic Nursing. By Edward P. Davis, A. M., M. D. Second edition, revised. 1904. 8vo. 402 pages. W. B. Saunders & Co., Philadelphia, New York, London.

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Nothnagel's Practice. Tuberculosis and Acute General Miliary Tuberculosis. By Prof. G. Cornet, of Berlin. Edited, with additions, by Walter B. James, M. D. Authorized translation from the German, under the editorial supervision of Alfred Stengel, M. D. 1904. 8vo. 806 pages. W. B. Saunders & Company, Philadelphia, New York, London.

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OPENING OF THE SURGICAL BUILDING AND NEW CLINICAL AMPHITHEATRE OF THE JOHNS HOPKINS HOSPITAL.

A large audience, composed largely of members of the medical profession from Baltimore, the State of Maryland, Washington, Philadelphia, New York, Boston and other cities, was present at the opening of the surgical building and clinical amphitheatre upon Wednesday, October 5, 1904, at 11 A. M.

Dr. W. H. Welch presided and introduced Hon. H. D. Harlan, the President of the Board of Trustees of the Hospital, who spoke as follows:

It is my pleasant duty on behalf of the Trustees to welcome you to the simple ceremonies attendant upon the formal opening of this new building, devoted to clinical medicine and surgery. We are much gratified at the number of our friends who have assembled. We make our special acknowledgments to the distinguished physicians and surgeons, pathologists, and other masters in the world of medical science, who have journeyed from afar, and particularly to those who have consented to deliver addresses on this occasion. That so many have done us the honor to accept our invitation is evidence (if any be needed), that the work of the Johns Hopkins Hospital and Medical School is not unknown or unappreciated either at home or abroad.

At the time of the death of Johns Hopkins, on Christmas Eve, 1873, there was no Johns Hopkins Hospital, although there was a corporation which Mr. Hopkins had caused to be formed during his life, and a board of trustees carefully selected by him, who were engaged in gathering information and in making plans not only for the buildings which were to be erected on this site, but also for the organization of a medical staff and the equipment and operation of the institution they were to bring into existence.

The task which was set for these trustees was one of great responsibility; and, while a large latitude of discretion was vested in them, they were not left wholly without guidance as to the intentions of the founder. In a letter of instructions written in 1873, he had, among other things, said, (1) "that they were to provide for a Hospital, which, in construction and arrangement, should compare favorably with any other institution of like character in this country or in Europe," and (2) "that it should be their special duty to secure, for the service of the Hospital, surgeons and physicians of the highest character and greatest skill."

These directions have ever been borne in mind by the Trustees. We may speak to-day of the wisdom and forethought, the sagacity and prudence, of the charter Trustees and their successors during the formative age of the Hospital without any self-glorification, because not one of the original Trustees still lives, the two last survivors having died in quick succession during the past summer—much beloved and much regretted by their associates; and because, with the single exception of Mr. George W. Corner, to whom all honor is due for his long and faithful service, extending over more than twenty-nine years, not one of the present Board was in office when the Hospital was dedicated in 1889, and only one when the Medical School was opened in 1893.

How well the earlier Trustees fulfilled the trust reposed in them with reference to the construction of the Hospital is indicated "by the international reputation of the Hospital as a model of hygienic construction, by the influence it has had upon the building of later hospitals, and by the conspicuous place which the plans of the Hospital occupy in recent treatises devoted to the discussion of the methods and problems of hospital construction."

How successful they were in their plan for the organization of the medical staff of the Hospital and the selection of its members the brilliant record of the work of this staff during the past fifteen years will attest. These years have been years of marvellous advance in medical science and research everywhere; and that the members of the staff of the Johns Hopkins Hospital and Medical School have contributed, to speak with moderation, in a marked degree to this advance is universally admitted. If proof were required of the proud position they occupy, it could be furnished by the action of that venerable seat of learning, Oxford University, in coming to the Johns Hopkins Hospital to take away, much to our regret, our Dr. Osler to make him its Regius Professor of Medicine.

One cannot contemplate the growth of this institution, its far-reaching influence, the results accomplished in the brief space of thirty years since Mr. Hopkins died, without a kindling of the soul and without being profoundly impressed with the thought that he was right in his belief that his wealth was given to him for a great purpose, and that this purpose he discovered, and that it is being grandly accomplished.

The relation of the Johns Hopkins Hospital to the Medical School was determined by the founder of both in these words: "In all your arrangements in relation to this Hospital you will bear constantly in mind that it is my wish and purpose that the institution shall ultimately form a part of the Medical School of that University for which I have made ample provision by my will."

The Trustees have sedulously endeavored to follow this injunction. They have kept it in mind in the construction of the Hospital, designing it with special reference to its uses for higher medical education and research; in the organization of the medical staff, making the professors and teachers in the Medical School their chief officers and advisers; in the liberal policy they have adopted in supplying means for original investigation, and in supporting the Hospital publications for the dissemination of the knowledge here gained.

This building is the latest product of the recognition by the Trustees of the obligation imposed upon them by the founder towards the Medical School and medical education. The growth of the classes in medicine and surgery demanded enlarged clinical accommodations, and for some time the necessity of securing better facilities for the surgical work of the Hospital has been brought to the attention of the Trustees. This building is intended to furnish these accommodations and to provide all the facilities necessary for the most modern surgical work.

I beg that, as you examine it, you will note how much of it is devoted to teaching purposes. The plans were prepared by an accomplished architect of our city, Mr. George Archer, who has had a large experience in hospital construction, under the direction of the Superintendent and Mr. Charles F. Mayer, the Chairman of the Building Committee, and with many consultations with the chief of every department for whose use it was intended. We believe the result obtained will be highly satisfactory, and, like the other buildings at the time of their construction, it will, as the founder wished, compare favorably with any other of like character in this country or in Europe. It is cause for sincere regret that Mr. Mayer, who gave to the details of the plan so much of his time and who was so deeply interested in its construction, has not lived to see its completion. We hope that this building will mark a new era in the advance and work of the Hospital.

The present year has been full of vicissitudes in the affairs of this institution. Five of its oldest, most active and useful Trustees have been removed by death. In the early part of January, we were shocked by the sudden death of Mr. John E. Hurst, long a member of the Finance Committee of the Board. The embers of the great fire had scarcely ceased to smolder when the unexpected death of Mr. Mayer, the Chairman of the Building Committee, occurred, at a time when we most needed his services. In August, the sad news come from the north, where he was recuperating, of the death of Mr. William T. Dixon, who had held the position of President of this Board for a period of eleven years, and had only retired from it, as we hoped, temporarily until his health should be restored. He had hardly been laid in his grave when an end came to the life of Mr. Lewis N. Hopkins, who had served the University and the Hospital as Secretary of their respective Boards for many years; and early in September, Mr. Francis White, a member of every important committee of the Board, the trusted friend of Johns Hopkins, and the last survivor of the Trustees selected by him, expired. All of these were deeply interested in the Hospital's welfare and gave of their time and experience to its service without stint and with the most self-sacrificing devotion. Their fidelity to the duty they had undertaken is an inspiring example to their successors.

Our fiscal year had hardly opened when the great conflagration which devastated the business center of the city destroyed sixty-four warehouses, stores and office buildings belonging to the Hospital, and we were suddenly brought face to face with a loss of income of sixty thousand dollars a year, arising from the cutting off of the rentals of these properties, and a loss of endowment of about three hundred and eighty thousand dollars.

Great anxiety was felt lest it should become necessary to curtail the work of the Hospital. No note of encouragement came to us which touched us more deeply than offers from members of the medical staff and nurses to remit their salaries. Fortunately our anxiety was relieved by the liberality of Mr. John D. Rockefeller, who, after having thoroughly familiarized himself with the work and management of this institution, placed at the disposal of the Trustees five hundred thousand dollars to repair the fire losses and to enable them to go on with its work without diminution. We were and are profoundly grateful for this timely aid. The state also came to our assistance in this time of distress, and the legislature appropriated twenty thousand dollars a year for two years as an offset to our loss of income.

With this help the work of the Hospital has gone steadily forward and the Trustees have taken resolute hold of the situation arising out of its properties in the burned district. Already buildings are in course of construction, some approaching completion, or plans are prepared for rebuilding, on more than half of its sixty-four lots. Some have been disposed of to advantage, and we trust that, as a result of the liberality of Mr. Rockefeller and the generosity of the state, the fire may prove after all not to have been a misfortune.

The Trustees have many problems to face. Not the least difficult of these is the necessity for an increase in the endowment of the Hospital to enable it to grow and develop and occupy the field that lies open to hand. Additional wards are needed to accommodate a larger number of poor patients and to afford greater clinical facilities for the Medical School. A new Children's Ward is required. The Nurses' Home should be enlarged to provide quarters for the increase of nurses made necessary by the growth of the Hospital. The pathological laboratories must be increased in size to meet the increase of students in that important department.

The investments of the Hospital's endowment have been watched with the greatest care, and, while there has been some shifting of values, the net result is, that the endowment, received from the executors of Johns Hopkins' will, remains unimpaired, but rates of interest are diminishing, and the growth of the work in every department has been so phenomenal that the expenses of the Hospital are constantly increasing.

How are we to meet them? This will soon become a pressing question. But we face the future with good courage, confident that this great charity, this Hospital, with its glorious past history, its present opportunities and future prospects, will not be allowed to languish; and as lately in our hour of need a benefactor was found, so in the days that are fast approaching, others, who are seeking to employ well the wealth with which they have been blessed for the largest benefit of mankind, will recognize the claims of the Johns Hopkins Hospital and the Medical School.

Dr. W. S. Halsted was introduced and gave a brief account of the educational aims of the building and dwelt especially upon the facilities which it would afford for the teaching of surgery.

Dr. Lewis A. Stimson, of New York, Professor of Surgery in Cornell University, then delivered the following address:

It is a great privilege to be permitted to take part in the opening of this building, a building devoted to the surgical relief of suffering and to the advancement of the art and science of that relief.

In that collocation of terms, sanctioned and sanctified by long usage, the art is named first, and with good reason. The science long had scant title to be named. We have the authority of no less a master of science and the scientific method than Huxley for the statement that they are practically the product of the century that has just ended; and what is true of science in general is much more true of the science of surgery. That has been created within our own times. Half of the men now living and practicing surgery have seen its birth and all its growth. In that creation the men connected with this University have borne a worthy part, and to its advancement a notable part of this building is devoted, a signal recognition not only of the importance of that scientific work, but also of the labors and successes of those who have here done it in the past, and who in doing it have added so much to the honor and the renown of the University.

Heretofore that work has been carried on without a specific equipment for the purpose, and this building is a recognition by the Hospital Trustees of the value and importance of the work, of their confidence in those who have carried it on, and of the need of observation, experience, and experiment for the proper advance of the science and the improvement and extension of the art.

It must be gratifying to those under whose direction this great University has won so pre-eminent a place to reflect that its surgical division, so widely known and so highly honored as it is, is in fact its own child, that its personnel is of its own upbringing and development, that its reputation and its honor are the crown of its own methods and labors. Before the medical department was established he who is now the head of the surgical division was studying and working in the pathological laboratory which so wisely had been made the foundation-stone of the complete structure which was to follow. And when a head was sought for the new division, a surgeon for the Hospital and an incumbent for the new chair of surgery, he was found within your own walls, trained in your own methods, imbued with your own ideas, working in full harmony with his associates. His success was immediate and has been continuous. Into the details of Professor Halsted's work and success the time is not now ours to enter, great as they have been, interesting and stimulating as the story would be. It must suffice, here and now, to say that his work has been characterized by industry, thoroughness, an accurate scientific method, and great originality. In everything he has wrought he has stepped out from the beaten path and opened new lines. Uncontrolled by tradition and established practice he has not been content to perfect accepted methods, but he has gone back to underlying principles, and upon that sure foundation has developed ideas and procedures which have been illuminating in their effect upon practice. He has shown the courage of conviction based upon thorough investigation, and in the carrying out of his ideas he has protected his patients by an accurate and exhaustive technique to which his own contributions have been most valuable and are now universally accepted. And under him has appeared here, presumably as the result of his influence and example, a corps of junior officers whose work is everywhere acknowledged to be of the greatest value in itself and of rich promise for the future.

Although in the world of science all men are kin, and the teaching ranks of one university freely draw upon and are in turn drawn upon by others as the need of enlargement or repair arises, yet the possession of such an adjuvant and reserve force as you have here created gives a most comforting assurance of your ability to carry on your work not only with unbroken continuity but also almost unchecked even by such a grievous loss as the one you have just sustained and in which we all share. Surely it will be permitted to me to pause for a moment to speak just one word in recognition of all that has been done by him who is leaving you, for medical science and the renown of your University and in appreciation of the personal qualities which have so endeared him to all, and to wish the fullest measure of opportunity and happiness in his new field to your departing colleague, Professor Osler.

The revolution effected in the practice of surgery in the last three decades is known to everyone. It has been coincident with and dependent upon the creation and development of a new science, that of bacteriology, and it has been carried to such perfection in detail and technique that it would hardly be thought unreasonable to say that so far as regards the treatment of the wound made by the surgeons no important additional advance is to be anticipated. The surgeon to-day divides almost any tissue, opens any cavity, exposes any region of the body with the confident anticipation that the injury he inflicts will be promptly repaired without danger or permanent loss to his patient.

This has, of course, enormously extended the field of operative surgery, has brought within the range of relief and cure conditions before which our art formerly stood helpless, and by substituting early inspection during life for tardy inspection after death, it has taught us to recognize disease while still it is relievable, to anticipate and prevent disaster, and to write the natural history of processes of which formerly we knew only the ultimate term.

The story is too familiar to permit more than a reference to it in this gathering. Our minds turn instead to the future. We ask in what directions will this laboratory increase our knowledge, and what errors, what exaggerations, if any, what defects of their qualities have grown out of our past progress to interfere with the welfare of those who are to occupy these wards.

Some of these problems of the future are concerned with the incompleteness, the occasional failures, of the knowledge already acquired and the methods already established. Others deal with new material.

Among the latter the most prominent perhaps is that of the origin and nature of the malignant neoplasms, of cancer, in a word. After making all allowance for possible error by defective records or faulty diagnosis, it seems unquestionable that the importance of this subject is daily increasing through increasing frequency of occurrence and through the gradual extension of the disease to periods of life which have heretofore appeared almost immune. The deaths by cancer, in its various forms, now constitute one of the largest groups in our mortality records. We have indeed made some gain in its treatment. We remove it earlier and we remove it more thoroughly; and we can show not only a delay in recurrence, but also a much greater escape from it. And for this, in one of the most prevalent forms of the disease, and voicing, I am sure, the opinion of the whole profession, we have to thank the clear insight, the courage, and the technical skill of Professor Halsted. But we still remain ignorant of the nature and the cause of this disease, powerless to prevent its appearance or to arrest its development, able only somewhat better to do for it what has been done for centuries.

And this although many observers have long been actively engaged in its investigation. That its origin in a germ should be suspected was of course inevitable, and not only because of the extent to which the germ theory of disease has occupied our minds and the many cases in which it has been proved, but also because of prominent features in the life history of the disease which seemed to show a close analogy with other diseases in which such causation was fully recognized, and of the prospect of gain to the sufferer which such a discovery would open. But the search has thus far been inconclusive, and at present the line of investigation which seems to hold out the best promise is that of physiological chemistry, in the hope that it may disclose some quality in the growth utilizable in the treatment, or in the nature of a toxin produced by it, the effects of which may be successfully combated. Thus far we can say little more than that differences from the normal in the proteids of the growth, and from inflammation in the form of cell-division (Farmer) have been demonstrated. The extension of the study to tumors in the lower animals, notably by the English observers and by Moran and Jensen, together with the success of attempts to transplant, justifies the expectation that a much more thorough investigation by experiment is possible. and the hope that our knowledge of the essential nature of the cell-process may thereby be increased.

The value of the X-rays in treatment, too, is yet to be measured; meanwhile they have shown that the vital resistance of the morbid cells to them is less than that of the normal cells, and thus is suggested a possibly fruitful line of investigation.

The remaining problems in wound-infection and sepsis, notwithstanding the enormous gains that have been made, are still of very great importance and complexity. Speaking broadly, we may say that our technique in the treatment of fresh wounds is established and that our success in the prevention of their infection is assured. But yet we still have our failures, even our disasters, therein; and in the wide field of wounds infected before they come to us, of patients already septic through one cause or another, our power to save is still sadly restricted. So long as the fight against the bacillus can be waged outside the body it can be won; but when once a lodgment within the body has been effected the bactericidal agents upon which we elsewhere rely with so much confidence cannot always be effectively employed.

The natural history of the micro-organisms has long been studied ardently and successfully, and our knowledge of them is now sufficient to make us their master under ordinary conditions, and our technique competent to protect our wounds. We do not, and cannot, prevent all access of bacteria, but we can and habitually do limit the number of those which enter to an amount with which the tissues of our patients are usually able successfully to deal. What we do not know, and what we gravely need to know, are those conditions in our patient which nullify the bactericidal power of his tissues and transform them into a soil favorable to the rapid growth and multiplication of specific micro-organisms, to recognize such conditions beforehand if possible, and to combat them successfully. When the infection is comparatively mild, when it remains for a time measurably local, we can usually overcome it by measures analogous to those which we employ to prevent infection; but when it is violent, when the entire organism is acutely involved, we are comparatively helpless.

Serum therapy, which has done so much good in allied conditions, has proved ineffectual here. The bacilli of septic infection differ greatly from those others in the products they form, in their action upon the tissues, and in their reaction to remedial agents. The diphtheria bacillus, for example, kills by a toxin which it produces in a localized growth. Under cultivation outside the body it produces an abundant diffusible toxin which in turn when introduced into an animal produces an abundant antitoxin, and that antitoxin introduced into the patient neutralizes the toxin there produced by the bacillus and thus saves the patient's life; and as this neutralization is effected, so the bacilli cease to multiply and soon disappear.

In septicæmia, on the other hand, the micro-organisms rapidly invade all parts of the body and kill not solely by a poison of their own production but by one which results from the combined action of the bacterial and tissue cells. To arrest this process it is not sufficient, so far as we know, to neutralize the poison; the bacilli themselves must first be destroyed. In some allied infections this destruction of the micro-organism can be accomplished by an antitoxin obtained from the blood of an immunized animal aided by a complementary body normally found in the blood of the patient. But the animal immunized against the streptococcus produces the corresponding antitoxin in only very scant quantities, and it finds the necessary complementary body only in the blood of animals of the same species. The serum of the immunized rabbit will protect or cure another rabbit; it is practically powerless in man. Even the complementary body found normally in man diminishes in sepsis almost to the point of disappearance, and thus is created another gap in the necessary chain.

Furthermore, the toxic effect of the streptococcus varies within so wide limits for the same culture that we must infer an explanatory difference in the resistance of the tissues of the individual, a difference the cause of which is only in part known or conjectured. Under the term "resistance" is of course to be included the capacity of the organism promptly and effectively to rid itself of the poisons manufactured within it by the bacilli, or possibly by the tissue cells under influences which bring about a perversion of metabolism. Illustrative examples can be found by every surgeon in his own experience. A simple, almost minor, operation which suggests no thought of danger is followed by the rapid development of a high temperature and early death with no evidence of more infection than would ordinarily be easily overcome. Or in another, less simple, less free from infection, a general condition promptly supervenes which indicates a fatal arrest of the eliminatory, or a grave alteration of some intermediate function. The habitual gravity of puerperal sepsis can hardly be fairly attributed to the virulence of the infecting streptococcus; it suggests rather a change in the soil, a change presumably dependent upon the entrance of the organism upon the function of gestation; and the grave modification or the arrest of the function of the liver or the kidney under the action of agents that can affect it only mediately through the nervous system shows a delicacy of balance which should impose upon us a watchful reserve in those classes of cases in which interference has shown itself most likely to affect it.

And how shall we explain, and how guard our patients against those overwhelming intoxications which occur so promptly when tissues have been *half* killed, when the circulation still goes on through them?

Studies of cell ferments show the possibility of sudden and complete inhibition or reversal of function of the ferments in the internal organs, and the detailed study of the nitrogenous excretion may reasonably be expected to lead to a clearer understanding of the cases and possibly to prevention or cure.

Such cases can be thoroughly worked up only by the collaboration of experts in several branches. They need not only the clinician and the pathologist, but also the bacteriologist and the physiological chemist; and such collaboration can hardly be provided by a hospital which is not connected with a well-equipped institution of learning. It is, however, practicable here, and such is now your opportunity. The work that has been so well done in the past is a guarantee that your enlarged opportunities will be appreciated and utilized.

In these instances of problems awaiting solution which have been mentioned the functions of the laboratory are mainly concerned, and it is but natural that so marked a step for the advancement of our science, so notable a provision for the sound establishment and furtherance of our art as its creation should attract attention. But we do not forget that it has been created and that it will be maintained by you for the benefit of suffering humanity, and that in the adjoining wards, in the work of the clinician, is to be found the reason for the existence of the laboratory, the end and the object of the work to be done in it. The observation which does not lead to the reduction of physical ill, the promotion of health, the relief of suffering, has no right to be deemed a part of medical science. The laboratory is the handmaiden of the ward, and its achievements must be controlled and tested by the clinician and must derive their final crown of honor from the use which he can make of them.

And while it is his correlative duty to suggest lines of investigation and to familiarize himself with what is there gained, he remembers that this is but one of the many sources from which he must draw aid and information, one of the many fields which his vision must survey, and that he himself must supply much of the material for and indicate many of the lines of investigation. And rich and brilliant as the clinical record of the past is in advances made and obstacles overcome by the aid of the laboratory, it contains also many an equally notable one accomplished entirely within its own field, many a valuable addition or supplement to the results of laboratory research, or explanation of what there remained obscure. Let me briefly recall in illustration the work done by one man in one disease.

Is there any disease to-day more widely known, more banal, than appendicitis? Its occurrence is so frequent, its recognition is so easy, its treatment is so successful that the conception of its danger has slipped into the background, and the surgeon's interest in it has even become a part of the stock in trade of the professional humorist. And yet, less than two decades ago it was known clinically as a disease that was generally fatal, and known pathologically only in its late, its most advanced form, and even there but incompletely known and with no conception, clinical or pathological, of the common mode of origin and of the means of recognition in the stage in which it is now habitually met and overcome. The profession spoke of, and the books described as separate and distinct affections, typhlitis or cæcitis, cæcal retention, perityphlitis, paratyphlitis, gangrene or perforation of the appendix, acute idiopathic peritonitis, and intestinal obstruction, with no grasp, without even a suspicion of the causal relation which makes them all parts of one nosological entity, and they disputed only from time to time whether the perityphlitic abscess was extra- or intra-peritoneal. The treatment was limited to opium and expectation, to be followed, if the patient survived long enough, by a surgical evacuation of the abscess if that could be accomplished without an exposure of the peritoneum to what was deemed an inevitably fatal contact with its contents.

In the remarkable paper read by Dr. Reginald Fitz before the Association of American Physicians in 1886, in which the word appendicitis was, I believe, first spoken and which did so much not only to call attention to the subject but also to clear the way to a full understanding and a rational and successful treatment, conditions of the appendix which we now know to be the consequences of the disease were spoken of as causal conditions, and in the discussion which followed he said "So impressed have I been with the obscurity of the signs of incipient inflammation of the appendix that no attempt has been made to consider the process until there was evidence that perforation had taken place."

Too much praise, too hearty a recognition cannot be given to this paper which deserves always to hold a high place in our grateful remembrance. It was written by a physician for physicians, but it clearly showed the surgical need and opportunity and commanded the surgical attention which so promptly followed and which furnished the information needed to complete our knowledge and to establish a successful method of treatment, and which, it should also be noted, added so much to the development of the surgery of the abdomen and to our understanding of the pathology of inflammations of the peritoneal cavity.

About a year after the publication of Dr. Fitz's paper, Dr. Sands did the first operation for the prompt relief of a perforation of the appendix into the abdominal cavity and reported it in a paper which, while containing some current erroneous conceptions, pointed out in the clear and trenchant manner so characteristic of that great surgeon the surgical need and opportunity in that class of cases and the manner in which they could be properly met.

In the few months of life which remained to him Dr. Sands actively pursued the study of the subject in conjunction with Dr. McBurney, who immediately succeeded him as surgeon of Roosevelt Hospital, a position which during his incumbency became the most influential center of surgical teaching in New York. His clinics were frequented by men already in practice, and this added largely in the rapid spread of his opinions through the medical community. Opportunity multiplied rapidly and its first fruit appeared in a paper read by Dr. McBurney before the New York Surgical Society in November, 1889 (N. Y. Medical Journal, December 21, 1889), followed a year later by another on the "Indications for Early Laparotomy in Appendicitis" read before the Medical Society of the State of New York in February, 1891.

In these papers, based wholly on clinical experience, Dr. McBurney gave what was essentially a complete picture of the disease in its pathology, course, symptoms, and treatment. Synthesis was substituted for differentiation, and the widely different conditions previously subjected to separate consideration were brought together under one rubric and shown to be diverging developments of processes originating in a common cause. The great frequency of this initiatory condition was demonstrated, and the means by which it could be readily and surely recognized and safely and efficiently treated before it had progressed to those perilous conditions in which alone it had previously been recognized, were described in detail with the support of a large and successful experience. He showed not only that the means of recognition of the early condition were so accurate as fully to justify anticipation of its rapid and dangerous progress and to demand active treatment, but also that the treatment recommended, the immediate removal of the affected organ, was vastly safer than expectation, even if the comparison included the mild cases which recover unaided within a few days.

It was shown also that the same plan of treatment, incision directly into the abdominal cavity, was also the best for the later and the intermediate stages, that even as a means of exploration to determine the presence or absence of pus, upon which operative interference had previously stood waiting on the brink, it was safer than the exploratory needle puncture which had previously been employed, and that it also offered the safest means of treating the abscess if one should be found. His cases showed that pus could be safely evacuated across the peritoneal cavity, that its contact with the peritoneum was less dangerous than the prolongation of its retention beside it while awaiting its progress toward the surface or its spontaneous opening into the bowel, and that, finally, in the latest stages, the same free incision held out the best chance of recovery by the drainage and the relief of tension which it supplied.

A little later he devised a method of operating which preserved the full strength of the abdominal wall and thus removed an objection to the early and possibly avoidable operation which had been urged with some persistence and force.

It is not easy for one who did not work in the antecedent period to appreciate the vast relief that came from this simplification of the problem, from the easy and early recognition of the disease and from the removal of the doubts and hesitation which embarrassed treatment. The relief was immediate and widespread and was felt even more by the physician than by the surgeon. It has wrought inestimable good, and the story, which well deserves to be told at much greater length than is here permissible, is a constant stimulus to thorough, intelligent, and conscientious labor.

Finally, in the future, it seems to me, the part of operative surgery will be somewhat lessened, at least relatively. I trust it will not be misunderstood if I say that in some respects we might be compared to one whose position has been changed by an unexpected inheritance from poverty to affluence, and who does not at first fully grasp the limitations or the responsibilities of wealth. We suddenly found ourselves able to do with great safety things which previously had carried great risk, a risk which often was prohibitive. It was natural, and proper, that that gain in our resources should be pushed to the utmost, that we should enjoy all that it could properly give, and that its limitations should be established by experience. To that first exuberance, to the feeling that any operation might properly be undertaken because the wound would heal kindly, is succeeding a more reserved attitude. We appreciate that even if a wound heals well, the tissue that has been repaired after our cutting is not always as sound as if it had not been put in need of repair. To the hopeful expansion of the frontiers of our operative interference is succeeding the less dramatic but equally useful elaboration and perfectioning of what has been acquired, and the recognition of the conditions and limitations of the advance. We hear less often the argument "He will surely die if we do nothing; let us therefore operate." We appreciate that of two evils it is a less one that our patient should die of his disease than that he should die of our attempt to cure him. Our exploratory work, too, is more closely restricted to obtaining only such information as can be utilized in treatment, and less is done which though harmless is also without benefit. There is so much necessary and legitimate operating to be done that we are freed from the insidious temptation to add to our numerical record and spurred to improve our results.

The future is rich in promise that is almost within our grasp, promise of advance in our science and promise of help to those who are in need of our art. And to you who have builded and to you who are to make use of what has been built, I wish a hearty Godspeed in the illustrious and beneficent work which lies before you and of which your past offers so sound a guarantee.

Dr. T. Clifford Allbutt, Regius Professor of Physic at the University of Cambridge, England, after congratulating the Hospital upon the erection of a building which promised to do much to advance clinical teaching, spoke briefly of the relations of medicine and surgery.

Dr. A. Jacobi, of New York, spoke as follows:

I am not here to sail under a false flag. Dr. Welch has just said that I have been a teacher of his, but for two dozen years at least he has been so to me, as well as to the profession of the United States and of Europe. Now, statistics prove that provincials have a tendency to crowd into centers. No wonder then that I, like the wise men of the East, come at this time to the shrine of Johns Hopkins. In appreciation of that fact your good and great men have consented to give me an opportunity to prove that I am not a good extemporaneous speaker. Indeed words fail me to express my feeling at such an occasion as this. There is no necessity for me to repeat what the new buildings that have been inaugurated to-day stand for. They will do a great deal for medicine, a great deal for Johns Hopkins, and a great deal for the world of science through the Johns Hopkins. Through the Johns Hopkins I say, for in the last quarter of a century, indeed even in less time, Johns Hopkins has succeeded in proving itself one of the head centers of the world and of science. It has largely contributed to the rapid changes that have taken place in medicine. Up to half a century ago it was an art only. It has since developed into art and science, and grown not only in its theories, but also in practice and usefulness. That is what Cicero meant when he said that all our glory was of no use unless what we did was useful, and also our own Benjamin Franklin, who claimed that all philosophy was useless unless it could be put to some use in the interest of mankind. That was the way Rudolph Virchow looked at medicine and at science in general. Many of you were present thirteen years ago when his seventieth birthday was celebrated in this very Johns Hopkins. At that time we learned a great deal about that great man whom some of us had not known. He was really a greater man than Aristotle for Aristotle with all his gifts and accomplishments, was only a great naturalist. He was a greater man than was von Haller, for Haller knowing everything knowable did not have the immense horizon of Virchow. I like to speak of Virchow, because he has been my example and he has been that example to all those who now live and those that will come after us as one of the greatest men, not only in medicine, but in man's history. He saw, like Sokrates and Kant, the future welfare of mankind in medicine. He created the best in general and special science that Johns Hopkins stands for.

As a pathologist he elucidated the cause and seat of illness. As a therapeutist, acknowledging that we are in a new era of therapy, he believed in drugs, but more in schools, education, culture, good roads, industry, and all the demands and blessings of democracy. He was the apostle of sanitation and prevention, and promoted the hygiene, physical, moral and mental—of the individual, the city, the state and mankind. As a humanitarian he claimed that the physician was the attorney of the rich and poor alike, and the guardian of all social problems. As a statesman he found no trifle too small, no great aim inaccessible. To him it was as important a law to help, as to fight one another.

We cannot all be Virchows. But next to accomplishing a great goal, comes the earnest wish to accomplish it. The best the young medical men of the nation can do is attempt it. There is much to do in every direction. Do not forget illness is not confined to individuals; human society is still abnormal and diseased. There must be remedies for them all. Though the best of us be more or less impotent, we should be aware that there must be means to reach every reasonable end. Cure and prevention are required for the individual and for mankind. There is no better way to them than through medicine. That is what I wish I could impress upon the minds of you, the young men to whom the future belongs with all its privileges and responsibilities. And I know of no better way to medicine than through Johns Hopkins.

I am glad to be here to participate in these exercises, as a deeply interested listener, to congratulate the teachers upon having greater facilities to instruct, the students upon their improved opportunities to learn, and the city of Baltimore upon the new glory in store for it. With all that, I have to thank those who have established these institutions for this new foundation by which they have added new accommodations for the sick, rich and poor, and a benefaction to mankind.

Dr. D. C. Gilman, ex-President of the Johns Hopkins University, was introduced by Prof. Welch as the first Director of the Hospital, he having held that position upon the organization and opening of the Hospital in May, 1889.

Dr. Gilman humorously acknowledged the introductory remarks of Dr. Welch, and then called attention to three points which might be emphasized at the close of this hour:

First, we should remember that it was the munificence of one person, a lady now present, which enabled the Johns Hopkins authorities to establish this Medical School. After years of waiting for the lack of sufficient funds, she made possible what many had hoped for. In her presence I will not venture to say all that would be appropriate under other circumstances, but I am sure you will gladly be reminded that it was a great, untrammeled and generous gift from Miss Mary E. Garrett, which initiated this school of medicine and prepared the way for the rich fruits of medical skill and knowledge which have been rehearsed by the speakers before me. (Applause.)

Next, let me remind you that the good results which have here been attained, results that are good not only for the sufferers here relieved, but for suffering humanity everywhere, these results have been reached by the harmonious co-operation of three institutions, the University, the Hospital, and the Medical School. I do not know where you can find an exact parallel to this union.

The University from its inception laid its plans for the encouragement of those branches of natural science, physics, chemistry and biology which underlie the science of medicine and in other ways it upheld the ideal of broad liberal culture. Then came the Hospital so finely endowed, so admirably arranged, so well administered, and so well manned by distinguished physicians and surgeons. Then came the Medical School. These three sisters may be likened to the ancient statue with which you are familiar, three Graces with arms intertwined and hands locked. Neither one without the other could accomplish so much.

Third, after all the key to the success of this institution, has been the maintenance of lofty ideals from the very beginning. When Dr. Welch was here alone, when he was joined by Dr. Osler and Dr. Halsted, and soon afterward by Dr. Kelly, all the way through, the loftiest ideals have been upheld. I believe they always will be while the spirit of Dr. Hurd and President Remsen pervades these institutions Look at Boston, New York, Philadelphia, Cleveland, Chicago, California, and other centers of medical science and hospital practice, and you will find in all these places young men trained under the teachers here assembled. Their knowledge has gone out to all the world. Even the University of Oxford comes to Baltimore for a torch-bearer.

Finally, let me remind you that it is the individual student who goes out from among us who shows what this institution is. We are soon to unveil a memorial to Lazear, dear Lazear, who sacrificed his life for the good of mankind, and not long hence, in Washington, another Johns Hopkins man is to be honored by a great memorial, Major Walter Reed. If this University, if this Medical School, if this Hospital had produced these two men only it would be worth all the cost. Young men, emulate their examples. Live up to the lofty ideals brought before you by your teachers, the great and the wise, the learned and the skillful.

After an inspection of the buildings a luncheon was served at 1.30 P. M. in the Administration Building, and at 3 P. M. the audience reassembled in the clinical amphitheatre to witness the unveiling of a tablet to Dr. Jesse W. Lazear, a former officer of the Johns Hopkins Hospital, who died in Cuba of yellow fever in 1900.

Dr. William Osler presided and spoke as follows:

It has been well said that Milton's poem Lycidas touches the high-water mark of English poetry; I do not know but that it may be said the high-water mark of all poetry. This is true not only because the poem appeals to us by its intrinsic merit and worth, but because it touches that chord in each one of us which responds at the personal loss of some young man to whom we had become attached. Those of us who have got on in years mourn many young fellows whom we have seen stricken by our sides. We have had in this Hospital fortunately only a few such losses. We have lost on the medical side Meredith Reese, Oppenheimer and Ochsner, and we have also lost a man of rare worth, in whose memory we meet to-day, whose story will be told you by Dr. Carroll and Dr. Thayer, Jesse William Lazear, a Baltimore boy, a Hopkins graduate of the Academic Department, a graduate of Columbia University in Medicine and a resident physician of this Hospital, the first man to take charge of our clinical laboratory, who, in Cuba, sacrificed his life in the cause of humanity.

Assistant Surgeon James Carroll, representing the United States Army Medical Corps, was then introduced and spoke as follows:

As a member of the Army Medical Department and a former associate of Dr. Jesse W. Lazear, I am proud to join you in honoring the memory of one to whom the State of Maryland, the Johns Hopkins University and the United States Army may point with genuine pride and affection. Acting Assistant Surgeon Lazear was the first person to produce an undoubted case of experimental yellow fever with the mosquito and it was he who first worked out the key to our present knowledge that we can control this devastating disease which has been justly designated the plague of the American continent.

Because of his previous experience while working with Dr. William Sidney Thayer, in the study of malaria-transmitting mosquitoes, Dr. Lazear was chosen to conduct the first mosquito experiments of the Army Yellow Fever Board, and as the result of his own individual work he enjoyed the satisfaction of producing the two first authentic cases of experimental yellow fever on record. Then with a full knowledge of the power of the insect to convey the disease, he afterwards calmly permitted a stray mosquito that had alighted upon his hand in a yellow fever ward, to take its fill, and inject into his system the virus that twelve days later robbed him of his life. About a month prior to this he had deliberately applied to his person with negative result another mosquito of the genus Stegomyia that had bitten a yellow fever patient ten days before. It is true that in the present instance he did not think the insect belonged to the genus that had been shown to convey the disease, but who could say at that time that more than one genus would not convey it? He made no attempt to capture or preserve the mosquito nor did he make any record of the fact that he was bitten, nevertheless the fact remains that he deliberately submitted to the bite, and accepted all the chances that went with it, whether of infection with yellow fever, filariasis or what not. As soon, however, as the nature of his infection was established he at once appreciated the significance of the bite to which he had submitted; he then related the circumstance to me, emphasizing his belief that the insect was not a *Culex fasciatus,* but, as he expressed it, "a common ordinary brown mosquito," in which the hospital at that time abounded. This statement is not so surprising if we remember that the markings of different Stegomyiæ of the same species may vary greatly in their distinctness, and that some of the wards of Las Animas Hospital were heavily shaded by foliage and were very dark, especially in the corners, where some of the beds were located. Under such conditions the markings of an old insect might readily escape observation.

It is very sad for those who knew Dr. Lazear to contemplate the loss to his family and to the profession, of one so true, so energetic, so gifted, so well equipped and so ambitious, but thanks to the efforts of his friends in this University his memory will be preserved by the handsome and fitting memorial dedicated to him to-day and his achievement will stand as a monumental stimulus to other young men, who will have imbibed their hunger for knowledge from the same fount as he, and who will go forth imbued with the same intense desire to relieve suffering and to acquire further knowledge for the benefit of the human race. The value to the United States alone of the work that he began can be estimated in millions and I hope the time is not far distant when the beautiful city of Havana will display a suitable monument to him who accomplished the first step in proving Dr. Finlay's theory of the transmission of yellow fever by the mosquito, and who laid down his life in the actual prosecution of that work.

At the time the Army Board met on the 26th of June, 1900, Dr. Lazear had been on the Island several months, and during that time he had fearlessly visited and studied a number of cases of yellow fever both during life and after death, not in the army alone, but among the civil population as well. He had taken many cultures at autopsies and had studied many films of blood, stained and unstained, so that he was already able to say with confidence that cultures and blood examinations promised nothing of unusual interest.

Dr. Lazear was indefatigable and his labors were frequently prolonged into the night in the little cottage where he lived alone in happy anticipation of a visit from his beloved wife and family. Owing to the strict quarantine that was maintained, there were but few cases of yellow fever at

Columbia Barracks and it was necessary for him to visit Las Animas Hospital, about five miles distant, in the suburbs of the city of Havana. It was here, while applying mosquitoes to a patient, that he received the fatal bite on September 13, 1900. Five days later on the evening of September 18, at eight and eleven o'clock P. M., he suffered two chills and was found in bed with fever next morning. I examined his blood for malarial parasites twice on the 18th and again on the morning of the 19th, each time with negative result. This, together with the clinical symptoms, made the diagnosing fairly conclusive, and in accordance with the custom he was then removed to the yellow fever isolation camp. Before his removal he turned over to me his notes covering all the attempts at mosquito inoculation and told me of his own experience of which he had made no record. For three days he barely held his own, then the gravity of his symptoms increased, black vomit supervened, he became delirious, and death closed the scene one week from the day of onset.

Thus ended a life of brilliant promise at the early age of thirty-four. Dr. Lazear died in order that his fellow-men might live in happiness and comfort. We know that only last year, when one thousand cases of yellow fever occurred in Texas, the scenes of 1878 would have been repeated in the South but for the work that was begun by him. It is no exaggeration to say that hundreds, nay perhaps thousands, in the southern states to-day unconsciously owe their lives, certainly their prosperity, to the results of the work in which he was engaged and for which he and his family have paid such a fearful penalty. The world lost in him a benefactor; the profession a man of high attainments, noble character and lovable disposition; words cannot measure the loss to his widow and orphans, the younger of whom he had never seen.

This grand University will always be proud of Lazear, whose name will forever be associated with that of Reed in the history of the transmission of yellow fever.

Dr. William S. Thayer then said:

As we meet to-day to dedicate this plate to the memory of our dear colleague, it seems but yesterday that Lazear told me of his desire to make use of the advantages which service in Cuba offered for the study of malaria and other tropical diseases and of the opportunities which had been held out to him by authorities of the army. It was, indeed, but five years ago. But in another sense how far away that time seems. For, as it ever is with truly great discoveries, the blessings of which are immediately appreciated by all mankind, certainty and enlightenment soon dull the memory of the groping past and we almost forget that the time ever was when this knowledge was not ours. And if we estimate the length of his life by the results which he helped to achieve, the day that Lazear left for Cuba was, truly, long ago, and the few months which remained for him to live, measure up to a riper lifetime than that which lies before many of us more fortunate to-day in the eyes of the world.

Of the four names connected with the noble work of the Yellow Fever Commission, two were of men who were students, associates or comrades of those of us who remember the Johns Hopkins Hospital fourteen years ago. Alas, neither is with us to-day! Both Reed and Lazear worked in these laboratories and wards, walked these corridors and lived under this roof, and both were deservedly loved by their colleagues and friends. It is not for me to-day to speak of Reed of whose simple, noble, upright character, of whose fine qualities and achievements you all know, but I would say a few words of Lazear as a man and a friend. Born near Baltimore, where his mother still lives, Lazear graduated from the Academic Department of the Johns Hopkins University. Studying medicine at Columbia, he afterwards served two years at the Bellevue Hospital in New York. After the term of his hospital service he spent a year in Europe, in part at the Pasteur Institute in Paris, after which he served a year as bacteriologist to the medical staff of this Hospital. In 1896 he married and began the practice of medicine in Baltimore. Holding the position of assistant in clinical microscopy in the University, much of his time was spent in research work in the clinical laboratory. During his interneship he had succeeded, for the first time, in isolating the diplococcus of Neisser in pure culture from the circulating blood in a case of ulcerative endocarditis. The three years which followed were devoted mainly to the study of questions concerning the malarial parasites. Lazear was the first in this country to confirm and elaborate the studies of Romanovsky and others concerning the intimate structure of the hæmatozoa of malaria, work appearing unfortunately some time after its accomplishment and, indeed, after his death. He was, with Wooley and myself, the first in this country to partly confirm the work of Ross and the Italians on the mosquito cycle of the malarial parasites. These studies in particular fitted him for the work which the Yellow Fever Commission was to undertake in Cuba, and the part which he played in that work was essential and important. But of this Dr. Carroll has already spoken.

I wish, especially for the younger men here, that I might be able to picture to you Lazear as a man and a companion. Quiet, retiring and modest, almost to a fault, he was yet essentially a manly man with a good, vigorous temper, well controlled, and rare physical courage. He was one who made his own plans and worked out his own problems; with a deep love of his profession and an ardent desire to make adequate contributions to its advance. He always seemed to me a man of promise, and but a few weeks before his death, I had warmly recommended him for the vacant chair of medicine in a northern university.

When the news of his cruel death became known, there were those who blamed what they regarded as unjustified temerity, who felt that such risks were not for married men. With this I cannot agree. No man loved his family more than Lazear; but he was engaged in a great work—and he knew it in a work where at the moment no substitute could take his place. Lazear saw his duty clearly and where he saw his duty fear and doubt could not enter in.

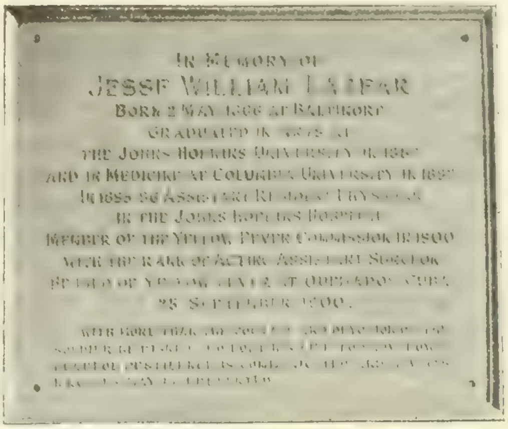
A few well-known lines of Emerson tell the whole story:

> "Though love repine, and reason chafe,
> There came a voice without reply,
> ''Tis man's perdition to be safe,
> When for the truth he ought to die.'"

It was that voice which guided Lazear as it has guided in the past and will guide in the future many a good and brave man.

(The tablet was then unveiled.)

I may add a few words about the history of this plate. Shortly after Dr. Lazear's death many of his friends wished to have a fitting memorial for him in some way connected with this Hospital with which he had been identified, and subscriptions were asked for a fund. We had no thought of collecting a large sum of money but in a very short time nearly twenty-five hundred dollars were subscribed. With a small part of this sum this plate has been secured while the rest constitutes a fund for the benefit of the children of Dr. Lazear. Foremost in the movement for collecting this fund was Dr. Stewart Paton, who regrets, I know, very deeply that he may not be here to-day. The inscription upon this plate was written by President Eliot of Harvard University.



MULTIPLE PRIMARY CARCINOMATA OF THE ILEUM.

By C. H. Bunting, M. D.,

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Carcinoma of the small intestine is a comparatively rare lesion. Of the whole extent of the alimentary tract the jejunum and ileum form the part least affected by new growths. This statement is well borne out by several sets of statistics. Nothnagel,[1] in his analysis of the material from the Allgemeines Krankenhaus in Vienna from 1870 to 1893, found 243 intestinal carcinomata, of which but 10 were of the ileum. Leichtenstern[2] found 780 intestinal carcinomata distributed as follows: 17 duodenal, 3 of middle ileum, 13 of the lower ileum, 9 of the ileo-cæcal valves, 3 of the appendix, 20 of the cæcum, 6 of the ascending, 30 of the transverse and 11 of the descending colon, 42 of the sigmoid flexure and 616 of the rectum. Lubarsch[3] records from the Pathological Institute in Breslau 24 rectal carcinomata, 14 of the colon, 2 of the duodenum, 1 of the middle and 1 of the lower ileum, and at the time of the publication of his article (1888) could find but 35 cases of primary carcinoma of the ileum recorded in literature. In the first 2200 post-mortem examinations in the pathological department of the Johns Hopkins Hospital there have been 104 carcinomata of the alimentary tract, exclusive of the buccal cavity, which have been distributed as follows: of the œsophagus, 12; of the stomach, 60; of the duodenum, 3; of the ileum, 1 (the case reported below); of the cæcum, 22; of the colon, 18; of the rectum, 8.

The small intestine from the entrance of the common duct in the duodenum to Meckel's diverticulum in the lower ileum is a simple unbranched tube, without variation in its type of lining epithelium, without sharp bends, without diverticula and containing, as a rule, in health semi-fluid mechanically non-irritating material. The infrequent occurrence of malignant new growths in a tube of such a nature is the negative evidence which allows of the generalization, from the positive evidence afforded by the other sections of the digestive tract, that carcinomata are most prone to arise where there are changes in the type of lining epithelium and at points where the surface is most liable to mechanical irritation. Further evidence is added by such cases of carcinomata of the small intestine as those reported by Waldeyer[4] and by Birch-Hirschfeld,[5] in which the new growth has arisen at a point where peritoneal adhesions have interfered with the normal action of the intestine.

The neoplasm in the case here reported is published not solely because of its location in the middle segment of the ileum, but also because of the multiplicity of the primary lesion and of the histological nature of the growth. The case came to autopsy in the service of Dr. Welch at the Johns Hopkins Hospital from the medical service of Dr. Osler.

The patient, Columbus D., hospital number 44,573, a negro aged 52 was admitted October 31, 1903, complaining of symptoms referable to broken cardiac compensation. Physical examination showed the P. M. I. of the heart to be in the V l. i. s. 14 cm. from the midsternal line, where it was feeble and irregular. On auscultation the sounds were feeble and irregular at the apex, the first accompanied by a soft murmur. Otherwise the examination was negative. Blood examination showed red blood corpuscles 4,480,000, white blood corpuscles 7,900, hæmoglobin 65 per cent. The patient died 5 hours after admission and his condition was such that no accurate history could be obtained, however the notes obtained from his wife give no evidence that the intestinal lesions found post mortem, had given rise to any noticeable symptoms during life.

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[1] Specielle Path. u. Therapie, vol. xvii, p. 308.

[2] Ziemssen's Handbuch, vol. vii, p. 523.

[3] Virchow's Archiv, 1888, vol. cxi, p. 280.

[4] Virchow's Archiv, 1872, vol. lv, p. 67.

[5] Lehrbuch der Path., p. 918.

The autopsy was performed by the writer, November 1, the protcol being as follows:

The body is that of a well built colored man, 165 cm. in length. The pupils are equal. Rigor mortis is present. The abdominal cavity appears normal.

Thorax.—There are quite firm old adhesions in the left pleural cavity. The right side is practically free from adhesions. The pericardium shows a slight excess of fluid.

Heart.—The heart is large. The pulmonary artery contains fluid blood and soft clot. The right auricle is dilated. The tricuspid valve seems normal. Its orifice is apparently dilated and measures 14 cm. The pulmonary valves are delicate and normal and measure 8 cm. There is some hypertrophy of the right ventricular wall, which averages 4 mm. in thickness. There are hypertrophy and dilatation of the left auricle. The mitral orifice admits three fingers and measures 10.7 cm. There is slight thickening of the free edge of the valve. The chordæ tendineæ appear shortened. The aortic valves are thickened. The aortic orifice measures 7 cm. There is considerable sclerosis at the base of the aorta. There is but one coronary orifice which lies above the left anterior segment of the aortic valve, and is the orifice of both the coronary arteries. The right coronary is covered at this point by thick patches of sclerosis in the aorta. The heart muscle is very soft. On tangential section the muscle is pale and cloudy, showing scattered yellow areas. The papillary muscles show transverse yellow striations and on section besides a definitely yellowish musculature show translucent greyish areas which are firm and apparently fibrous.

Lungs.—The left lung shows old adhesions over the upper lobe. The surface is quite deeply pigmented. The lung appears air-containing throughout. The cut section is rather moist and congested. There appear to be no areas of consolidation throughout the lung. The right lung is quite similar to the left. The bronchi are free. The mucous membrane is slightly injected, otherwise it appears normal. There are no ante-mortem clots in the pulmonary arteries.

Spleen.—The spleen weighs 80 gms. and measures 10 × 7 × 3 cm. It is small. The capsule is opaque and greyish-purple in color, thickened and wrinkled. The trabeculæ are thickened, and stand out prominently. The vessels stand open. The Malpighian corpuscles are increased in size.

Liver.—Weighs 1200 gms. and measures 22.5 × 18.5 × 6.5 cm. The liver is rather small. The surface is smooth throughout. The edge is sharp. The cut section shows congestion of the central veins. The lobules are sharply marked out and appear to have a normal color. The gall-bladder appears normal. The bile ducts are patent.

Kidneys.—The left kidney measures 11.3 × 6.2 × 4 cm. The capsule strips easily, leaving a smooth regular surface and the cut section shows a cortex about normal in width, and of a good color. The vessels are much injected. The glomeruli are prominent. The right kidney resembles the left.

Stomach.—The stomach appears normal.

Pancreas.—The pancreas appears normal.

Intestine.—The intestines show in the upper part of the ileum, six nodular structures varying in diameter from 3 to 7 mm. and projecting into the lumen of the intestine. These nodules lie opposite the mesenteric attachment, are scattered through a section of the intestine about 50 cm. in length, and are separated from each other by intervals varying from about 1 to 15 cm. of normal intestine. The nodules are of an opaque white and firm to the touch. The inner surface is covered by mucosa which appears slightly movable over the nodules. On section the nodules appear to be made up of fibrous tissue and contain many punctiform areas of a more opaque white color. Throughout the upper part of the ileum and in the upper part of the colon, there are in the submucosa many small nodules about 1 to 2 mm. in diameter, of an opaque color which are apparently a proliferation of lymphoid follicles.

Mesenteric Glands.—The mesenteric glands appear normal.

Bladder and Prostate.—Appear normal.

Aorta.—Shows a moderate sclerosis.

Anatomical Diagnosis.—Chronic mitral and aortic endocarditis. Cardiac hypertrophy and dilatation. Fatty degeneration of the heart with fibrous myocarditis. Sclerosis of aorta. Congestion and œdema of lungs. Chronic passive congestion of the abdominal organs. Interstitial splenitis. Carcinoma of ileum.

Microscopical Examination.—The heart muscle shows atrophy and hyaline and fatty degeneration of its elements, with diffuse increase in interstitial tissue, accentuated at various points to definite fibrous patches. This is especially marked in the papillary muscles.

The lungs show emphysema with congestion and œdema.

The abdominal viscera show the results of chronic passive congestion.

No organ microscopically shows signs of primary or secondary new growth.

The Tumor Nodules.—The structure of the several nodules of the intestine is essentially the same and a description of one will suffice for all. The smallest nodule was studied in serial sections, the largest in multiple sections by various stains, hæmatoxylin and eosin, Mallory's connective tissue stain, Weigert's elastic tissue stain and Van Gieson's picro-fuchsin. Over the largest nodule the villi are few and are flattened. The epithelium is lacking over the nodule except at one point where there is a slight depression and here it appears normal. The basement membrane of the surface epithelium, however, is intact throughout. Over the greater part of the nodule normal crypts of Lieberkühn are lacking. In their place one finds gland-like spaces filled with cells similar to those in the alveoli throughout the new growth, and from these, slender columns of cells run downward into the mucosa toward the muscularis mucosæ widening in many places into alveoli of considerable size in the mucosa. In one or two places at the edge of the growth similar columns of cells can be traced into direct communication through the basement membrane with the deeper parts of crypts otherwise apparently normal. But a minor part of the new growth is confined to the mucosa. The cells invade the muscularis mucosæ, spread apart its fibres and columns and penetrate it to communicate with the major part of the growth which lies in the submucosa. The tumor consists of a rather dense, cell poor fibrous stroma, in the upper part of which especially, there are fairly numerous smooth muscle fibres apparently derived from the mucsularis mucosæ. The stroma, especially toward the muscular layers of the intestine, shows areas of hyaline degeneration which appear dense and firm and stain deeply with eosin. The hyaline appears often as if deposited in masses of irregular shape and of various sizes. Throughout the stroma are alveoli many of which are of considerable size, and in a single section may appear isolated but are more often in free connection with each other by slender columns of cells. The cellular elements are small polymorphous cells with scanty clear protoplasm with vesicular nuclei which stain sharply and deeply with hæmatoxylin and which show definite nucleoli. The cells are densely packed together, the outer layer often appearing flattened. They are somewhat shrunken away from the stroma and no stroma fibrils are demonstrable between the cells of the alveoli. The cells and their nuclei are quite uniform in size and staining reaction. Mitotic figures are infrequent. The majority of the alveoli are solidly packed with cells, but a few show a tendency to the formation of a lumen, due to the degeneration of cells at their center. The degenerated cells stain but slightly with eosin, their nuclei also lightly, their protoplasm is granular and their outline indistinct. Other alveoli are penetrated by coarse stroma strands, which in some cases are hyaline. The cells are shrunken away from these, the picture suggesting somewhat a cylindroma. The growth does not extend widely in the submucosa and appears to be limited by the growth of the stroma, which almost encapsulates the tumor. On the outer side, however, the cells invade the muscular layer, at one point penetrating it completely, a small group of cancer cells being found in the subserous tissue. The mucosa in the neighborhood of the growth shows an infiltration with polymorphonuclear cells with eosinophilic granulation but the stroma is free from them. There is no infiltration with small round cells.

The mesenteric lymph-glands show no metastases.

Summary.

In a male negro, aged 52, whose death resulted from cardiac disease and in whom the organs are generally free from signs of a new growth there are found in the middle portion of the ileum six nodules scattered over a length of intestine of about 50 cm. These nodules vary but slightly in size, and are beneath an intact epithelial surface. The nodules are uniformly of a definitely carcinomatous structure histologically, with apparent origin from the epithelium of the crypts of Lieberkühn, show some invasive tendency, but are without metastases in other organs.

There would seem to be three possibilities as to the nature of the nodules:

1. That they were all secondary to carcinoma in some other organ.
2. That one of the nodules was primary, and the others secondary.
3. That they were all primary carcinomatous foci.

The first possibility is definitely excluded by the negative findings in the other organs. There was no primary focus elsewhere. This is further supported by the infrequency with which secondary growths are found in the small intestine except as peritoneal implantations or as direct extension from some adherent new growth. That one of the nodules was primary and the other secondary seems improbable. Metastasis through the vascular channels of the mucosa or submucosa seems excluded by the observation that tumor cells could not be traced to even a microscopical distance to either side of the more or less circumscribed nodules, while in one case, at least, a length of normal intestine of fully 15 cm. lay between two adjacent nodules. Implantation along the serous surface is excluded, as but one of the nodules extended to that surface. Implantation on the mucosa surface, according to the idea of Klebs, would seem perhaps more difficult to exclude. While examples of such implantation are rare, and not all above criticism, this method of extension is one to be considered, and seems the only possible explanation of such cases as the one mentioned by Borst,[6] where a squamous-celled nodule was found in the mucous membrane of the stomach secondary to an epithelioma of the œsophagus, without other metastases. In the present case, however, the nodules seem approximately of the same age. Each one shows an intact basement membrane over it (the epithelial cells having suffered post-mortem desquamation), and what is of more importance, each nodule seems to show histogenic relation to the epithelium of the crypts of Lieberkühn over it. The case then by exclusion and by direct evidence is one of multiple primary carcinomata of the ileum. The case cannot satisfy the criteria of Billroth,[7] for the determination of multiple carcinomata that—

1. The carcinomata must show a different histological structure.
2. That each must be traceable histologically to the epithelium of its matrix.
3. That each must show its own metastases.

The criteria were obviously intended to apply to carcinomata arising in different organs, and the second is the only one applicable in the case under consideration.

That this case is not unparalleled would seem to render it of greater significance. Multiple carcinomata in various organs are considered an accidental occurrence, so might be considered also a single case of multiple carcinomata of the same organ. There are recorded, however, six cases so similar that the description of any one would describe the group except as to very minor details.

The cases in brief are as follows:

1. The first was described by Lubarsch in 1888.[8] In a male, of 49 years of age, there were found in the upper and middle parts of the ileum multiple tumors of a carcinomatous structure lying chiefly in the submucosa but penetrating also the muscularis. The nodule was made up of alveoli and communicating strands of cylindrical and rounded cells with scant protoplasm and with sharply staining vesicular nuclei with from 3-5 nucleoli. The stroma was cell-poor and showed in many places hyaline degeneration, cells at the center of alveoli often showed degenerative changes, which with the apparent grouping of cells about hyaline stroma fibrils gave a picture resembling closely the tumors described as "cylindromata." Lubarsch was able to trace at one point the direct connection of tumor cells with the crypts of Lieberkühn. There were no metastases. The condition was associated with tuberculous ulcers of the intestine.

2. A case also reported by Lubarsch with the above, a man aged 52, in whom were found six carcinomatous nodules in the ileum, corresponding closely in structure with those of the previous case, and where it was also possible to establish a

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[6] Die Lehre von den Geschwülsten, vol. ii, p. 733.

[7] Allg. Chirurg. Path. u. Therapie, 1889, p. 908.

[8] Virchow's Archiv, 1888, vol. cxi, p. 280.

direct connection between the new growth and the gland epithelium.

3. The case of Notthaft.[9] In a patient dying of pneumonia three nodules were found in the jejunum separated by 10 and 5 cm. of normal intestine. Histologically the nodules were carcinomatous, being made up of alveoli of polymorphous cells in a firm stroma, and in one nodule showing invasion of the muscularis. Direct connection with the glandular epithelium was found. There were no metastases.

4. The case of Walter.[10] A male of 50, dying of pernicious anæmia, showed two cherry-sized nodules in the middle of the ileum, which the author describes briefly as carcinomatous in nature invading the muscularis, showing direct connection with the crypts of Lieberkühn and agreeing in general structure with the cases of Lubarsch and Notthaft. There were no metastases.

5. The case of Oberndorfer,[11] a woman aged 30, dead of typhoid, showed three nodules in a 70 cm. length of intestine, of a similar nature to those above described, and also without metastases.

6. There is possibly to be included a second case of Oberndorfer reported with the above, of a similar nature, where four nodules were found in the middle of the ileum of a woman who had died as a result of chronic tuberculosis. The nodules showed a rather fibrous stroma and alveoli filled with polymorphous cells, but as the author could find no definite connection with the intestinal epithelium, he regarded the tumors as lymphatic endothelial carcinomata.

This series of cases forms thus a distinct group of intestinal carcinomata differing in many particulars from the more common cylindrical-celled adeno-carcinoma of the intestine. The group is characterized by the multiplicity of primary foci, occurring at other than the usual points of predilection of intestinal growths, by the undifferentiated character of the carcinoma cells, by the slight invasive tendency, by the failure to metastasize, and apparently by slow growth. Although several of the cases have been described as beginning carcinoma, it seems more rational to assume a slow growth and a benign course. The patients usually have been well along in the carcinoma age, and in none were the tumors apparently responsible for the death of the patient. No large multiple tumors have been described. Histologically, mitotic figures have been infrequent, and the stroma well developed and fibrous. Further even in serial sections of the smaller nodules it has often been difficult to trace the origin of the tumor from the glands. The cases stand out in sharp contrast to the case of multiple cylindrical-celled adeno-carcinomata of the jejunum and ileum described by Hammer.[12] In a man aged 60 there were four nodules in the small intestine which gave metastases to the mesenteric lymph glands, sixth rib on the right, fifth dorsal vertebra, the dura of the cord and the lungs. Yet one cannot assume that there is anything inherent in the nature of the growths to render them necessarily benign, for a single tumor of the ileum of identical histological structure and with abundant metastases has been described by Ranson.[13] They are, however, of benign tendency and, as far as can be derived from meager histories, produce no severe local or constitutional effects.

The resemblance between this group of tumors and a special group of skin cancers, which has recently received attention at the hands of Krompecher in his monograph "Der Basalzellenkrebs" is striking. Krompecher separates from the ordinary prickle-celled epithelioma, which occurs as a rule at transition points between skin and mucous membrane, as at the lip, which infiltrates and metastasizes early, a group which he terms basal-cell epitheliomata. The latter do not arise at the usual sites but at special points, as the cheek, the forehead, the scalp, grow slowly, infiltrate slightly and almost never metastasize, and are characterized farther by the retention by the cells of an embryonic undifferentiated character. As examples of this type he cites the group of multiple tumors of the scalp, fifteen cases of which have recently been collected by Dubréuilh and Auchè.[14] These tumors have been reported variously, by some as benign epitheliomata, by others as sebaceous adenomata and by still others as endotheliomata. They are always multiple, often existing in great numbers, their growth is indolent, they are superficial, do not invade to any extent and do not metastasize. They may occur as early as the twelfth and as late as the fifty-fourth year. Their duration (to the time reported) varied from 3 to 36 years, with an average of 18 or 19 years. In spite of their number and duration they remain benign and produce no constitutional effect. The authors conclude they arise from the cells of the hair follicles or the sebaceous cysts, but that the connection is early lost. The cells have a different aspect from those of the skin, being polymorphous with a small amount of protoplasm and failing to develop inter-cellular bridges, the characteristic "prickles." They further suggest that in view of the occurrence of such a group the proposition, that as the cells of a tumor approach the embryonic type they gain in malignancy, must be revised.

It is not the intent of this paper to discuss the appropriateness of Krompecher's term, basal-celled carcinomata, for this group of tumors, or the soundness of the wide application of his ideas, so as to include in the same group many tumors which are now considered of endothelial origin. He exempts the gastro-intestinal tract from the list of organs that may furnish basal-celled carcinomata, yet the resemblance between these two series of multiple tumors of intestine and scalp would seem to indicate that they belonged in a general way to a common group.

The recognition of multiple carcinomata from the same epithelial surface can apparently add little to our ideas of the etiology of carcinoma unless it be that the stimulus or impulse to malignant growth is less focal than is often assumed. It is but a step from the conception of multiple carcinomata to the conception expressed by Hauser,[15] in reference to gastric carcinoma, that "microscopically one can determine that an apparently single diseased focus is composed of a great number of separate groups of carcinomatous glands with groups of normal glands between;" in other words that a carcinoma arises from multiple primary foci closely related. Peterson[16] likewise has demonstrated (unless one incline toward the Ribbert view of secondary upgrowth of carcinoma cells) by wax reconstructions that skin epitheliomata may be multicentric in origin, and further that one finds also multicentric growth, that is by the continual starting of independent centers from the epithelium in the periphery of the tumors. The occurrence of multiple isolated tumors seems to support these views.

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[9] Deutsch. Archiv f. Klin. Med., 1895, vol. liv, p. 555.

[10] Arch. für Klin. Chirurgie, 1896, vol. liii, p. 1.

[11] Beiträge zur Path. Anat. u. Alleg. Path., 1901, xxix, p. 519.

[12] Prag. Med. Woch., 1896, vol. xxi, p. 212.

[13] Lancet, 1890, vol. ii, p. 1020.

[14] Annal. de Derm et de Syph., 1902, Series 4, vol. iii, p. 545.

In conclusion, I would emphasize:

1. The relative infrequency of carcinoma of the ileum.
2. The occurrence of multiple carcinomata in that location, with epithelial cells of an undifferentiated character, and with generally benign tendencies.
3. The resemblance between this group of intestinal tumors and the group of multiple epitheliomata of the scalp.

Since the completion of the preceding article a second case of multiple carcinoma of the intestine has come to section in the pathological service of the Johns Hopkins Hospital. The case differs materially from the preceding in most of its features, and seems worthy of record for contrast.

The patient, a German, aged 59, was admitted to the medical side, August 22, 1904, with symptoms referable to intestinal obstruction and with a palpable mass in the right iliac fossa. He was transferred to the surgical service, and an exploratory operation revealed an inoperable carcinoma in the cæcal region, and also a second mass in the sigmoid flexure. A palliative ileo-colostomy was made, and at a second operation, as obstructive symptoms persisted, a colostomy. The patient's condition, however, was not relieved and death ensued on August 29. The post mortem examination was made the following day. The detailed description of the organs, other than the intestine, will be omitted. It may be said, however, that there were no lesions of importance save sclerosis of the aortic valves, with calcification, leading to incompetency, sclerosis of the coronary arteries, cardiac hypertrophy and dilatation, and slight chronic passive congestion of viscera. The organs generally were free from metastatic tumor growths.

Intestine.—In the upper part of the ileum there is felt a firm mass which involves the whole circumference of the intestine and invades the mesentery, which is at this point thickened and contracted. On opening the intestine the lumen is found almost obliterated by the tumor growth which encircles it. Opposite the mesentery the tumor forms a rigid, firm band, 2 cm. in width and elevated about 5 mm. above the surrounding mucosa. Toward the mesentery the band divides to form two prominent, firm ridges surrounding a deep crater-like depression, with ulcerated surface and about 15 mm. in diameter. The ridges have a fungating appearance on the surface. The new growth is very firm and on section appears as a translucent fibrous tissue in which are numerous, fine, opaque lines and dots. The growth invades the muscular coat and also the mesentery, at which point it attains a thickness of 2.5 cm. The peritoneum is not involved.

In the cæcal region is a second very similar tumor growth with fungating surface and firm consistency. It involves the ileocæcal valves, extends irregularly almost about the cæcal lumen, and invades the retrocæcal tissue. The tumor seems to consist of one main mass, attaining a thickness of 3 cm., and a number of outlying smaller masses connected with it. The cut section is quite like that of the tumor in the ileum.

In the sigmoid is a third tumor, which does not tend to encircle the lumen, but takes the form of a fungating ring lying opposite the attachment of the bowel. The ring is about 5 cm. in diameter; is at its thickest part elevated 1 cm. above the mucosa, and surrounds an ulcerated depressed center 15 x 20 mm. in diameter, which extends practically to the peritoneal coat. The tumor shows less marked stroma growth than the two other foci.

Microscopical Examination.—Section of the ileum tumor shows a typical cylindrical-celled adeno-carcinoma, involving a wide surface area of mucosa, invading submucosa and mucosa, and extending along the vessels and nerves into the mesentery, but not involving the peritoneum. Toward the lumen the growth is made up of large, dilated and tortuous tubules, lined by atypical cylindrical-celled epithelium and with a definite lumen, filled in a few places with necrotic cells. The stroma is here fibrous but rather scant and showing small round-celled infiltration. Toward the outer margin of the growth the alveoli are smaller, in many places showing no lumen, but consisting of a group or short column of a few very atypical epithelial cells. The stroma is increased toward the periphery of the growth.

In the cæcal growth the surface mucosa seems also widely involved; near the surface the growth is of a definite adenocarcinomatous type like that in the ileum. However, where it breaks through into the retro-cæcal tissue the alveoli are much larger and are in many places almost completely filled by polymorphous epithelial cells, variable in size but as a rule small, with deeply staining nuclei, which also vary much in size and intensity of staining. Many of the alveoli show necrosis at their center. The stroma growth here is also dense and fibrous. Coarse fibrous bands give a gross alveolar appearance. Between the coarse bands there run many finer strands.

The sigmoid tumor shows again a slight variation in type. Large gland-like tubules run downward through the mucosa and submucosa, widening out into large alveoli with ingrowths from their walls, giving them a plexiform appearance. The alveoli are lined by slender columnar cells closely packed together and showing a tendency to heap up, and extend into the lumina, which are filled with mucus and scattered cells. The growth extends somewhat into the muscular coat, but does not involve the peritoneum. The stroma is but slightly developed.

In this case of multiple carcinomata of the cylindrical-celled adeno-carcinomatous type, with ulcerated surfaces, without involvement of the peritoneum, and without metastases in other organs, one does not seem able to say absolutely whether it is a case of multiple primary foci or whether of transplantation of tumor elements from the uppermost tumor and implantation on the mucous surface. Metastasis by lymph or blood channels seems excluded by absence of metastases in other organs and by the fact that in all the tumors the epithelium of the mucous membrane takes part in the growth. From the extent of growth and stroma development the tumors in the ileum and cæcum seem approximately of the same age, with possibly something to the advantage of the cæcal tumor as the older, while both show greater development than that in the sigmoid flexure. The fact of surface ulceration would lend itself to the transplantation and implantation idea, as would also the occurrence of the second, at the constriction caused by the ileo-cæcal valves. Yet somewhat against the view is the variation in type, slight though it be, shown by the three tumors. And again in the cæcum and sigmoid the new growth does not appear as an implanted metastasis, but the epithelial cells of the tubules of the mucosa take part in the new growth and show a carcinomatous change to as marked a degree as in the tumor of the ileum. Without knowledge of any infecting agent, it would seem that to maintain the implantation idea one must postulate the transfer not only of carcinoma cells but also with them, a carcinomatous tendency which affects the mucosa on which they become implanted. The author leans toward the view in this case that the foci are independent primary foci.

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[15] Virchow's Archiv, 1901, vol. clxiv, p. 165, quoting from his monograph, "Das cylinder Epithel-Carcinom des Magens u. des Dickdarms," Jena, 1890.

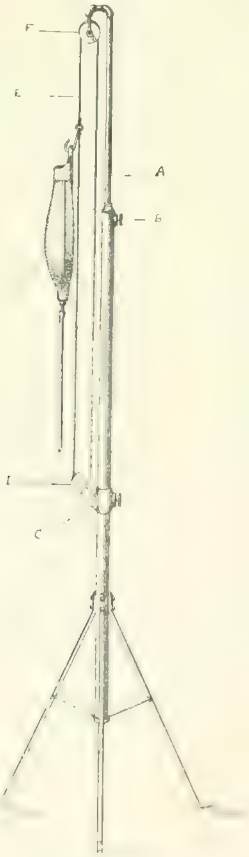
[16] Verhandlung d. Deutsch. Path. Gesellschaft, vol. iii, p. 61. Virchow's Arch., 1901, vol. clxiv, p. 570.

A NEW OFFICE IRRIGATING STAND.

By George Walker, M. D.,

Instructor of Surgery, Johns Hopkins University.

The accompanying illustration is a drawing of an apparatus which I have devised as an office irrigating stand.



Description.—*E* is a continuous cord, and is held between two brass pulleys, *D* and *F; D,* the lower one, is fixed so that it does not revolve. The holder, *C,* of the lower pulley, *D,* can be moved up and down so as to tighten the cord *E,* when it becomes slack or when it is desirable to hold a large vessel full of fluid. It also adjusts the cord to different heights of the ceiling. The upper rod *A* can be raised or lowered so as to accommodate the stand to high or low ceilings, the range being about two and a half feet. The screw *B,* holds the rod *A* when adjusted.

The hook on the cord is sufficiently large to hold a fountain syringe or a flat glass irrigator. I have made it longer in some instances so that it supports the ordinary glass percolator.

The advantages of this apparatus are as follows:

1. The bag or glass irrigator can be raised or lowered very easily with one hand.
2. It can be manipulated by the patient without being touched by the operator.
3. A gradually increasing pressure can be obtained without interrupting the irrigation.

I have also made the apparatus with the feet removed, so that it can be screwed to the side of the wall and thus take up less room.

The same principle I have applied to another device in which the upper pulley is fastened to the wall and the lower one held by a similar arrangement as is in the accompanying figure, not being, however, more than one foot in length, thus giving the holder sufficient room to be raised or lowered in order that the cord may be adjusted. This is held three inches from the wall, to which it is attached by means of a board. There is an absence of the upper rod and no connection between the pulleys except by means of the cord.

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CONCERNING A CASE OF SUPPURATIVE MYOSITIS CAUSED BY MICROCOCCUS GONORRHŒÆ (NEISSER.)[1]

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Since the successful culture of the gonococcus by Bumm (1) in 1885, the accumulating evidence of intervening years indicates a now wider area of capability for causing infection than had at first been deemed possible, when it was regarded simply as the specific factor in the etiology of gonorrhœa. To be fully convinced, therefore, of the important position that this organism occupies, one has only to turn to the ample list of references given in the second series of the Index Catalogue of the Surgeon-General's Library (2), and to the very recent and excellent review of the complications of gonorrhœa by von Hoffmann (3).

A careful review of such literature shows that muscular involvements following in the wake of gonorrhœal infection are not of very common clinical occurrence, consisting as they do of atrophies, myalgias and localized inflammations. And it is not the purpose of this paper to enter into a discussion of these clinically interesting phenomena beyond pointing out the rarity of occasions upon which any very definite bacteriological results have been attained in demonstration of the manner in which the latter two phases, at least, are produced.

To the studies of de Christmas (4) we are much indebted for our knowledge of the nature of the toxin of the gonococcus, which is, as he points out, of the intracellular variety and comparatively highly toxic. And from the studies of Wassermann (5), and Gross and Krause (6) of the action of this toxin upon the human subject, it would seem that both arthritic and myalgic pains and swellings and severe constitutional disturbances can be ascribed to it. "It appears, therefore," says von Hoffmann (7), "that the gonotoxin, whatever it may be, when it enters the circulation, causes more or less severe general affections, possibly functional alterations in organs (trophic), as in the kidney and skin, and *also local inflammations;*" but that local inflammations should be wholly ascribed to the action of gonotoxin cannot be with all fulness entertained, as, from the evidence presented in the following, it will appear abundantly clear that the gonococcus itself may be at times the sole active factor concerned.

In chronological order we will now consider those reports which present more or less evidence of the relation of the specific micro-organism to the lesions:

Councilman (8) reports a case of a male patient in the Boston City Hospital, who, following an attack of gonorrhœa, developed arthritis in both knees, shoulders and several fingers, and an acute pericarditis. He died on the tenth day. The autopsy diagnosis was urethritis, acute arthritis, exudative pericarditis and myocarditis involving the left auricle and ventricle. No cultures were made, but microscopic examination showed micrococci in the urethral and arthritic pus, and within leucocytes in the areas of myocardial inflammation, which decolorized by Gram's staining method. None were found in the pericardial exudate.

Budjwid's (9) case was that of a man suffering from a chronic gonorrhœa, who took a chill of a severe sort two days after catheterization, which was repeated several times within the following ten days. Shortly afterwards four abscesses formed and were located in the neighborhood of the left elbow joint, the right popliteal fossa, the inner side of the left leg and over the right external malleolus. "All abscesses were found in the muscles, none in the connective tissues or joints." Cover-slip preparations from the pus, and cultures on serum agar showed micrococci possessing all the characters of Neisser's gonococcus.

Iwanoff (10) reported a case of a woman suffering with gonorrhœal endometritis who died and came to autopsy. A small abscess was found in the wall of the left ventricle, and another in the parenchyma of one of the kidneys. No cultures were made, but a microscopical examination showed the presence of cocci which were believed to be mic. gonorrhœæ.

Servel (11), in a series of eighteen clinical observations, reports three in which investigation was undertaken. In Case X the muscle involved was punctured by a needle and the exuding juice examined in the stained state, yielding doubtful coccus-like bodies. Case XIV, exhibiting muscular involvement, gave on blood culture micrococci which in the absence of the application of Gram's stain were considered doubtful. Case XV, in which the left masseter muscle was swollen to the size of an almond, and on puncture furnished a semi-purulent fluid containing mono- and polymorphonuclear leucocytes, red blood corpuscles and diplococci of good size, which decolorized by Gram. No culture was made.

Ware (12) makes a contribution to the subject, of some interest, in that his patient came to him without giving any history of gonorrhœa, but complaining of severe pain around the right shoulder with inability to use the arm. Physical examination showed a tender indurated area about the size of a walnut in the post-scapular muscles. Local treatment availed nothing, and then on further questioning patient mentioned a previous chronic gonorrhœa, whilst his urine showed still a few threads containing typical gonococci. On cutting into the indurated area no pus was found, a bloody fluid only came away. Not suspecting gonococci, cultures were made on ordinary media at hand with entirely negative results, yet cover-slips showed micrococci decolorizing by Gram.

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[1] Read before the Johns Hopkins Medical Society at its meeting on December 15, 1902.

Turning now to our own case: A. C., female, aged 34 years, married, was admitted to Dr. Osler's service in Ward G on July 3, 1902, complaining of stomach trouble. *Family history* was excellent. *Past history* showed that she had had measles, whooping-cough, and, 12 years previously, typhoid fever. She never had rheumatism, tonsillitis, pneumonia, pleurisy, scarlet fever or malaria. *Marital condition:* Has been married 13 years, has four children, all living and well, no miscarriages. Menstruation began at 19 years, and has always been regular. Patient has had leucorrhœa for years, and since the birth of the last child eleven months ago has had no menses, but has been troubled with "the whites." She nursed her baby until three days ago. *Present illness:* Aside from the characteristic symptoms of a chronic dyspepsia of a year's standing, the patient says that four weeks ago a lump appeared in the calf of her right leg about the size of a hen's egg; this has now gone, only a diffuse swelling remaining. The lump was painful, as is the swelling now. There is no pain in the neighboring joint. *Physical examination* (in so far as it relates to our theme): Back—At the junction of the sacral and lumbar regions is a swelling which the patient says has been there for four months; it is about the size of a hen's egg. Legs—The patient holds her right leg semi-flexed, the calf seemingly very much swollen. Thirteen cm. below the lower border of the patella the right leg measures 34 cm., the left leg at a corresponding point 28.5 cm. Just below the tibial tubercle the right leg measures 29 cm., the left 25.5 cm. No difference is found in the measurements at the ankles. Glandular system—The submaxillary glands are enlarged, as are those of the anterior cervical triangles, of the right posterior and part those of the left posterior triangles; they are freely movable. There is no enlargement of the axillary, epitrochlear and inguinal glands. Hæmoglobin, 64 per cent. Leucocytes, 16,000.

NOTE BY DR. MCCRAE.—The patient looks rather emaciated, skin sallow, no jaundice. Gums and mucous membrane rather pale; tongue moderately coated. There is slight flexion of the right knee, which can be readily overcome by pressure, and the leg flattened. There is marked swelling of the calf of right leg, which has a boggy fluctuating feeling (measurements as before). At the lower end of this swelling is a pigmented area which the patient says has been there since last winter. The region is very tender. There is no evidence of involvement of the bones. Knee-jerks present on both sides. There exists marked enlargement of the glands of the neck, which are discrete and shotty. Over the sacrum is a boggy swelling which is very tender, yet the skin over it is not red. Considerable tenderness exists over the spines of the lumbar vertebræ. There is no definite lateral curvature of the spine.

July 4—Red blood corpuscles, 3,648,000.

July 7—A large hypodermic needle was inserted into the swelling of the calf of right leg and a small quantity of pus obtained on aspiration. Urine examination showed no abnormal state.

Medical Bacteriological Report.—July 6—The Gruber-Widal test for typhoid fever proved negative. July 7—Examination of the pus aspirated from right leg showed it to have a cream-like consistence and to be mixed with considerable blood.

Cover-slip preparations stained in methylene blue and gentian violet presented a moderate number of single cocci and diplococci outside of the leucocytes, all staining well, and decolorizing by Gram.

Cultures.—The major portion of pus was put into a flask of bouillon and well mixed; the smaller portion was smeared over the surface of a plain agar tube, and all were incubated at 37° C. July 10—The flask culture shows no growth in the supernatant fluid, nor any definite growth at the bottom, yet cover-slips made from the subsided pus demonstrate a very decided increase in micro-organisms, which are found singly, in pairs, in fours, and in clusters, and varying considerably in staining properties. An unstained zone surrounds quite a number, as if possessed of a capsule. When stained by Gram the vast majority are quite decolorized, a very few retaining the dye in a moderate degree. The agar tube previously smeared with some of the bloody pus presents eight small, round, gray, translucent, moist, smooth, glossy colonies, varying in diameter from 0.5 to 1.0 mm. Their morphological and tinctorial characters correspond to those in the flask culture. The contents of both flask and tube were now plated out in hydrocele-fluid agar, and also smeared over the surfaces of several tubes of the same medium.

July 12—Having been 48 hours in the incubator at 37° C., the plates exhibited in seemingly pure culture numerous small, round, grayish colonies, like those of *streptococcus pyogenes.* Examined under the low power of the microscope the surface colonies were round, edges regular, of a straw-yellow color, moderately granular, occasionally nucleated, all translucent; the deep colonies were round or irregular in shape, of a light brown-yellow color, rather coarsely granular, edges at times irregular, all translucent. Both surface and deep colonies when touched with the platinum needle were found to have a definite degree of viscosity, so much so that at times the whole colony would adhere to the needle; and on making cover-slip preparations with water considerable difficulty was experienced in spreading the film owing to this viscid quality. The organisms from these colonies were micrococci exhibiting much variation both in size and stainable qualities, some cocci scarcely imbibing any stain at all; they were found to be grouped singly, in pairs, in fours, and in clusters of irregular size. They decolorized completely by Gram's method. Transfers were made to Loeffler's blood-serum, plain agar, bouillon, potato, etc., and to hydrocele agar, and incubated.

July 15—Growth only on hydrocele agar. No animal inoculations were made.

DIAGNOSIS.—*Micrococcus gonorrhϾ.*

July 8, 1902—Operation by Dr. Follis.

(1) *Incision and drainage of abscess over sacral region, probably intramuscular.* An incision was made excising a portion of the skin over the abscess just above the sacrum. The abscess ran up into the erector spinæ muscles on both sides. There was considerable sloughing of the muscles, especially above their attachments to the pelvis. The abscess was thoroughly cleaned out and after about three ounces of pus had been evacuated it was swabbed with pure carbolic acid and alcohol and packed with iodoform gauze.

(2) *Incision and drainage of intramuscular abscess of the calf of the right leg.* An incision was made just behind the fibula on the right side. This was carried down through the skin and subcutaneous tissue and a large abscess which contained about one and a half pints of blood-stained pus was opened into and evacuated. The abscess was under the gastrocnemius and soleus muscles extending up into the popliteal space. There was considerable sloughing of these muscles and their tendons. A counter incision was made on the inner side of the leg, the abscess swabbed with carbolic acid and alcohol and packed with iodoform gauze.

The patient's temperature, which had ranged from normal in the morning to 102° in the evening, returned to normal on the third day after the operation and remained down during the 40 days' time that the large wounds required for healing.

Surgical Bacteriological Report.—A culture in bouillon was sent to the laboratory from the operating room, also a smear of pus. This smear contained both intra- and extracellular diplococci arranged in groups which decolorized by Gram's method of staining. Sub-cultures from bouillon on plain agar failed to produce any growth; on a hydrocele agar slant numerous small, gray, round colonies appeared in twenty-four hours. Smears from the growth on hydrocele agar contained diplococci arranged in short chains and groups which decolorized by Gram's method of staining. There was no growth in milk, bouillon, or on potato from cultures made from the hydrocele agar tube.

Diagnosis.—*Micrococcus gonorrhœæ.*

In view of the bacteriological findings the patient was, during convalescence, particularly questioned in hopes of eliciting evidence of symptoms pointing to a gonorrhœal infection, but beyond the knowledge of a leucorrhœa of long standing and occasional attacks of pain and sensations of burning while passing urine, nothing of a definite nature could be obtained. To exclude the possibility of the muscular condition being secondary to joint or tendon-sheath infection, the patient most positively stated that at no time did she notice any trouble in or about her joints or tendons, the trouble appearing directly in the regions affected, namely, in the calf of the leg and the muscles of the back.

Reviewing now the foregoing cases quoted from the literature, bearing upon our own, it will appear evident that from lack of cultural proof those cases reported by Councilman, Iwanoff and Servel can be only tentatively regarded as gonococcal in nature, whilst that of Ware may, without being hypercritical, be regarded as positive, inasmuch as he furnished negative cultural evidence in support of his microscopic findings. In quoting Budjwid's case in this connection, it is simply to call attention to the serious discrepancy between his assertions and his facts, for it is certainly imposing upon one's credulity to say that muscular abscesses can have existence in the anatomical regions he so clearly describes; his case cannot well be other than extension of the suppurative processes from the joints and tendon sheaths.

Summing up the evidence thus presented, it is proven that amongst other tissues of the body, the muscles can be the seat of secondary inflammatory metamorphoses occurring in the course of a gonorrhœal infection, caused on the one hand by the action of the intracellular toxins absorbed by the blood, and, on the other, by the direct implantation and action of the gonococci themselves, wherein may be found all grades of severity, from that of an early resolving, painful induration to such an extensive degree of suppuration and necrosis as was furnished by our case. From what we know, also, of the frequency of metastatic complications attendant on gonorrhœa, it would seem fair to assume that the chances are equal that the gonococci are quite as much concerned in these lesions as are the absorbed toxins. This assumption, however, can only be made good by the records of further investigation.

In conclusion, we desire to express our cordial thanks to Doctors Osler and Halsted for their permission to make use of the history of this case.

Note.—Within the interval between the presentation and publication of this article, Thos. J. Strong, M. D., reports in the *Journal of the American Medical Association*, 1904, May 14, p. 1288, a case under the title, "General Systemic Infection by the Diplococcus of Neisser Complicating Gonorrhœa," wherein muscular involvement was a prominent symptom. The case rests, however, on too meagre and doubtful bacteriological grounds to make it at all convincing.

N. MacL. H.
L. W. H., Jr.

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BACTERIUM CYANEUM: A NEW CHROMOGENIC ORGANISM.[1]

By Ethel L. Leonard, M. D.,

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This interesting micro-organism was discovered on several occasions in air-plates made in the Hendrix Laboratory by the students of the University of Southern California during the years 1900 and 1901, and, although searched for since, it has not been again encountered. The colonies attracted special attention on account of the deep blue pigment which was seen in the medium immediately around them; pure cultures were at once obtained from them and placed in our collection of bacteria in the Medical School for future observation.

The study of the organism has been unfortunately interrupted many times since the period of its isolation, but as opportunity offered systematic work has been done in our own laboratory and that of the Johns Hopkins University and Hospital.

A careful review of the literature and of the leading systematic treatises on bacteriology fails to show any organism whose description at all fits in with the cultural and biological features of this bacterium excepting Ps. syncyanea and Ps. cyaneo-fluorescens, from which it can be distinguished readily enough by certain well-marked characteristics (*vide infra*), and it is, therefore, with some confidence that I venture to present it as a new and distinct chromogenic organism, under the name of *Bacterium cyaneum,* adopting the binominal nomenclature of Migula.

The organism has little to commend it beyond its very striking production of blue pigment, yet for this very reason I was largely induced to publish an account of it, as it undoubtedly will fill a necessary place in the teaching of some of the elementary points in the subject of bacteriology.

The plan followed for the description is that recommended by the Bacteriological Committee of the American Public Health Association, published in 1898.

Bacterium cyaneum is a non-pathogenic, chromogenic organism, 1 to 2.5 microns in length, .7 microns in thickness. The forms seen in young bouillon cultures 24 to 36 hours old are the longest, being 2.5 and even 3 microns long, whilst those on fully developed agar or gelatine cultures measure from 1 to 1.5 microns in length. The organism is non-motile, and has in many specimens characteristic small clumps of bacteria which appear attached by their ends. They are also grouped in pairs at obtuse angles. The bacillus contains refractile, deeply staining granules which may be at either one or both ends, or situated in the body of the bacillus. Plasmolysis is often noticed in young cultures.

No spores, capsules or flagella have been demonstrated.

Bacterium cyaneum stains well in the ordinary aniline dyes, recommended by the Committee, namely, 5 per cent fuchsin; gentian violet, methylene blue and Loeffler's methylene blue. Some difficulty was experienced in obtaining well-stained specimens on account of the large amount of zooglœar material present.

After fixation the films should be washed in .5 per cent acetic acid solution before staining. Most satisfactory stains are obtained by the use of 5 per cent fuchsin or gentian violet. A 5 per cent solution of thionin demonstrates the granules, showing a marked differentiation between the deeply staining bodies and the more lightly stained protoplasm of the bacillus.

All stained specimens show small coccus-like bacilli, 1 micron long and 7/10 microns broad. These have no characteristic arrangement. Longer forms, however, 1.5 to 2.5 microns long, are found, sometimes irregular in form and clumped together in small groups. Others form the characteristic obtuse angles. In fully developed cultures on gelatin, agar and potato, the bacillus is about 1 micron long and has no typical arrangement.

Specimens are easily decolorized in weak acids, or alcohol, but are not decolorized by Gram's method of staining. The morphological characteristics in old cultures are essentially the same as detailed above, with an absence of the longer forms, and the presence of many swollen, lightly staining coccus-like types.

Bacterium cyaneum grows best at room temperature; grows well, but will not form pigment at 37 degrees C. Development takes place slowly at 15 degrees C., and at 10 degrees C. no growth occurs. A temperature of 68 degrees C. with an exposure of five minutes to moist heat destroys the life of the organism. Forty-eight hours' old broth cultures were used for this test. No growth takes place under anærobic conditions. (Test used, mica plate and fermentation tubes.)

Colonies on agar plates 24 hours old at 37 degrees C. are coarsely granular and greenish yellow in color. Many have nuclei; 48 to 72-hour colonies show three distinct zones; a nucleus in the middle, most externally a thin, coarsely granular, irregular edge, occupying about one-third of the colony, and between these two portions is a dense granular, greenish-yellow zone. In those colonies developing at room temperature, many fine, irregular, blue granules occur through the central portion of the colony. The surrounding medium is sometimes lightly tinged with blue.

Those colonies developing at 37 degrees C. do not show these irregular blue granules, which I believe to be the pigment formed by the organism. Superficial colonies 2 to 3 weeks old, show dappling with the blue granules scattered throughout the entire colony. Deep colonies on agar are lenticular or round, and on plates two or three weeks old, bosses are sometimes observed.

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[1] Read before the California State Medical Society, May 19-21, 1904, at Paso Robles, Cal.

Those deep colonies which penetrate the medium and become superficial have a characteristic appearance on agar plates. The surface portion of the colony spreads out in a fan-shaped manner, terminating in a thin translucent edge and the deeper portion of the colony might be likened to the handle of a fan which appears massed together in a cylindrical form at one side of the colony.

On a gelatine plate 24 hours old, the colonies are small, granular, browinsh-yellow and have circumscribed edges. The medium is unchanged, but liquefaction begins after 48 hours' growth and the gelatine is completely liquefied in from three to four days. The medium is slightly greenish-yellow. Deep colonies are lenticular or round, very small and granular.

Bact. cyaneum.	*Ps. cyaneo-fluorescens.*	*Ps. syncyanea.*
Morph.:—Bacilli, for the most part coccoid, 1 to 2.5 μ long, 0.7 μ wide—well defined rods not abundant. No spores. No flagella.	Short, thick bacilli, about 2 μ long and 1 μ wide. No spores. Bipolar flagella.	Bacilli, 2 to 4 μ long, 0.7 μ wide. Oval polar spores. Polar flagella.
Motility:—Non-motile.	Actively motile.	Actively motile.
Gram:—Positive.	(Not mentioned.)	Negative.
Gelatin:—Liquefied.	Not liquefied.	Not liquefied.
Milk (plain):—Peptonization without coagulation. No pigment formed.	Apparently unchanged, but addition of alkali produces a Berlin blue color.	May or may not take on a sky-blue color; addition of weak acid produces the blue pigment. No other change apparent.
Litmus Milk:—Slightly alkaline reaction. Peptonization without coagulation.	(Not mentioned).	Strong alkaline reaction. No peptonization or coagulation.
Potato:—Slow, moderate, yellowish, moist growth. A deep blue pigment slowly diffuses through medium after 8–14 days, beginning where medium is dry.	A vigorous, yellow-gray, moist, growth, turning to a muddy gray-blue. Medium slowly stained a brown-gray, or dark bluish-gray.	Similar to Ps. cyaneo-fluorescens, occasionally a little blue-black staining of medium close to growth.
Glucose Agar:—Surface growth at first yellowish-green, later has a gray-blue tint. Medium progressively and wholly colored a deep blue, altering later to brownish blue.	(Not mentioned).	Surface growth at first of neutral tint, turns a gray-blue. The upper $\frac{1}{5}$ of medium stains a blue-brown, changing often to a blue-black.
Pigment:—Deep blue with a violet cast. Readily soluble in water; slightly in alcohol; insoluble in ether and chloroform.	Brownish-blue. Insoluble in water, alcohol, ether, and chloroform.	Pigment composed of a fluorescent substance, and a body of a steel-blue or brownish-blue color. Both are soluble in water—(alcohol, ether, etc. ?).
Temperature:—Grows well at room-temperature and at 37° C.	Grows well at room-temperature and between 25–30° C.	Grows best at room-temperature, not at all at 37° C.

Litmus milk shows no change after growth for 24 to 36 hours. At 48 hours, the milk becomes more alkaline with a light green cream-ring, and showing no coagulation or peptonization. At the fourth or fifth day of its growth the blue color of the milk has completely disappeared and the peptonization without coagulation has taken place with a reaction seemingly neutral. The organism forms a blue precipitate at the bottom of the tube, which becomes a bright yellow a day or two later. The cream ring is deep blue even after eighteen days' growth.

Potato.—No growth takes place on potato until about the third or fourth day, when a small blue spot is noted in the medium, which slowly increases and permeates the potato. The surface growth then becomes visible as a greenish-yellow, moist, elevated growth. The development on potato is exceedingly slow and cultures one month old are often the most typical. The presence of moisture favors the development of the pigment.

Gelatin Stab.—Liquefaction of gelatin begins about the fifth day and may be napiform or transverse, the surface becoming liquified first and proceeding outwards and downwards in an even manner. In 10 per cent glucose gelatin, the entire medium becomes pigmented a deep blue before liquefaction begins.

On Loeffler's blood serum medium after 24 hours appears a growth with a yellowish-green color; it is elevated, moist and vigorous. After twenty-four hours further a slight blue color appears at the upper portion of the medium, especially if somewhat dessicated. After a week's growth the serum becomes liquefied and of an olive green color.

Growth on coagulated pleuritic fluid has about the same characteristics, but liquefaction begins about the fourth day.

Fermentation tests in dextrose-free bouillon show no gas formation, nor is gas formed in any sugar solution. In the bulb of the tube a green flocculent precipitate is present.

Experimental work on the pathogenic properties of *Bacterium cyaneum* have been negative thus far. Frogs and small guinea-pigs show no lesions after inoculation.

The pigment produced by *Bacterium cyaneum* is deep blue in color and non-crystalline, and seemingly has no intimate connection with the bacterial cell. It is soluble most readily in water, slightly so in alcohol, and insoluble in ether and chloroform. The pigment develops best at room temperature, also very slowly at 15 degrees C., but at 37 degrees C. no pigment formation takes place.

The power of forming pigment is not lost by growth at brood-oven temperature, however, as such a culture, even after growth for a week in the brood-oven, will regain its characteristic blue color if placed at room-temperature for 36 to 48 hours, either in the light or dark.

After a growth of from 18 to 24 hours all young cultures on solid media, agar and gelatin, show a pale green color in the surface growth, but no color in the medium. From 24 to 36 hours a purple color is present in the medium immediately below the growth; this gradually deepens to form the dark blue, which in four or five days diffuses throughout the entire medium. During this time the surface growth gradually assumes the same deep blue color. After two or three weeks, or less, the surface growth has become a chrome yellow, and the blue pigmentation of the medium loses its brilliant color and assumes a dull blue, and finally a wine color. This gradually fades in two or three months to a reddish brown, possibly due to oxidation.

Experiments on the various sugar media, glucose, lactose, sucrose and maltose, proved these to be of most value in the demonstration of the pigment. On 10 per cent glucose or maltose agar the pigmentation is more brilliant than on lactose or saccharose, although these two latter media show more pigment formation than is seen in those media not containing sugar.

Twenty-four-hour-old cultures on 10 per cent glucose or maltose agar present a vigorous, moist, pale green surface growth, with beginning blue color in the medium. This pigmentation rapidly extends until the entire medium is infiltrated. After a week or ten days the medium fades and becomes reddish, and later brownish-red with a yellow surface growth.

By reflected light the pigmentation appears wine color, and it seems probable that there are two pigments present, a blue and a red.

The chemistry and spectroscopy of this pigment will form the basis for future work.

Differentiation.—Apparently the only two organisms with which Bact. cyaneum might be confounded are Pseudomonas cyaneo-fluorescens (Zangemeister) Mig., and Pseudomonas syncyanea (Ehrenberg) Mig. A study of the table of comparison on preceding page will show several well-marked points of distinction.

My hearty thanks are due to Dr. Stanley P. Black, of Pasadena, Cal., for many helpful suggestions in the course of the investigation, and to Dr. Norman MacL. Harris for encouragement and assistance at several stages of the work.

References Consulted.

1. Chester's "Manual of Determinative Bacteriology."
2. Reports and Papers of the American Public Health Association, Vol. XXIII, 1898.
3. Sternberg's "Manual of Bacteriology."
4. Goadby's "Mycology of the Mouth."
5. Frankland's "Micro-organisms in Water."
6. Eisenberg's "Bakterien Diagnostik."
7. Flügge's "Die Mikroorganismen."
8. Migula's "Bakterien Systematik."
9. Matzuschita's "Bacteriologische Diagnostik."

NOTES ON NEW BOOKS.

A Laboratory Text-book of Embryology. By Charles Sedgwick Minot, LL. D. (Yale), D. Sc. (Oxford), Professor of Histology and Embryology in the Harvard Medical School. With 218 illustrations, chiefly original. (*Philadelphia, U. S. A.: P. Blakiston's Son & Co.*)

This new laboratory text-book of embryology is worthy of particular attention. It is a practical guide of a novel and original type, which is to be recommended as a valuable aid in laboratory teaching of a difficult nature. The volume is planned to help the student secure a first hand knowledge of mammalian embryology from the examination of specimens, by placing before him a few well selected stages and directing him in their detailed study. The idea is thus to give a real basis for an understanding of human embryology and anatomy, and this is attempted in the latter half of the book, beginning with chapter IV which contains the directions for practical laboratory work.

Prof. Minot outlines the plan on page 173, as follows: "A pig embryo of 12 millimeters has been selected as the center of study in this book because its anatomical relations are such that they may be readily grasped by the student who has already studied the anatomy of an adult mammal, human or other. At the same time the development of the organs is so far advanced that their fundamental relations may be observed. From an embryo of this size the transition to the study of other embryos is, even for the beginner, comparatively easy."

The 112 pages of chapter IV devoted to the examination of pig embryos form the original and the most novel departure in the work. The illustrations of the surface views, reconstructions, and microtome sections of the 12 millimeter pig embryo are carefully chosen, numerous, and exceptionally well executed; while the text contains an excellent and very full description of all noteworthy characters. Taking the 12 millimeter stage as a standard for reference, younger and older embryos are compared with it to explain the important changes which take place, while many accurate original figures of actual sections accompany the descriptive text. A feature of the treatment here is the skillful method of giving general information in connection with the description of special objects. With the aid of this portion of the book and a few specimens of young pig embryos, easily obtained,[1] a student, who is also provided with selected microscopic sections through the various regions of the bodies of a series of embryos of different ages, and who is acquainted with the elements of the anatomy of some mammal or of man, can readily become familiar with the main facts of development. If too great bulk could be avoided, a still further extension of the treatment accorded the 12 mm. pig to a few other stages would be well worth while.

In the next chapter, chapter V, very young chick embryos (first and second day) are selected to illustrate the earlier embryonic stages, leading up to the stages of the pig already studied. These early specimens are not readily secured in the case of the pig or other mammals, hence the chick embryos form a valuable substitute. This matter takes up about 50 pages, and the book is concluded with a few essentials of technique and the section of 40 pages on the Uterus, Placenta, Membranes, etc., in which human material is to be studied as a special preparation for work in obstetrics.

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[1] Ready prepared embryos may be had by applying to The Preparation Department of the Biological Laboratory, Tufts College, Mass.

Of the remaining part of the book, the first half is descriptive and general, and the matter included in it forms a supplement to the practical sections. It is sufficiently clear from the title that a systematic descriptive account of the development of the organs is not attempted. The student is referred to text-books of a different type for such an account. The topics here treated fall under the following heads: "A description of the germ-cells," "fertilization," "segmentation," the "germ-layers," "the development of the blood," "the first appearance of the vessels and the heart," etc.; as well as a brief review of the developmental history of the human embryo from its earliest stages up to a period of four months.

Chapter I of the book, which contains a statement of important general principles and fundamental facts underlying embryology, forms an excellent introduction and is a desirable addition to the practical chapters. The remainder of the first half of the volume, chapters II and III, is of evident value, though it includes subjects not falling exactly within the scope of practical laboratory study. On the whole, however, one would wish to see these sections retained in a revision, though, perhaps, some recasting may be advisable, to avoid repetition of topics already treated in other parts of the book in connection with the practical study of specimens. It would seem best to place most of such general and descriptive matter in an appendix at the end of the work.

This new laboratory text-book is a valuable addition to the list of available text-books of embryology. In fact, the book stands by itself and is an original departure in a very desirable direction, introducing the student to the subject by a practical method which promises excellent results. After a year's experience with it, we feel much confidence in its success.

H. McE. K.

Hand-book of the Anatomy and Diseases of the Eye and Ear. For Students and Practitioners. By D. B. St. John Roosa, M. D., LL. D., Professor of Diseases of the Eye and Ear in the New York Post-graduate Medical School; and A. Edward Davis, A. M., M. D., Professor of Diseases of the Eye in the New York Post-graduate Medical School. 300 pages, square, 12 mo. (*Philadelphia, Pa.: F. A. Davis Company, Publishers.*)

The authors state in the preface that "the present volume exhibits the present state of Ophthalmology and Otology in sufficient proportions to make an exact and reliable guide as to the principles of treatment of the diseases of the Eye and Ear, and to the anatomy of these organs." We cannot substantiate this view, and the beautiful babe in the eyes of the parent shows itself to us as an ugly duckling. The anatomy is too much abbreviated to be of service, but covers enough space to show a number of errors. On page 200 the authors speak of the auricle being attached to the *malar* and temporal bones. At another place they speak of the optic nerves having their *origin* in the thalami, etc. The cornea is not a highly polished membrane. We think an error of judgment is shown when small measurements are given with the inch as a unit instead of the millimeter. The authors use the following measurements: 1/20, 1/60, 3/2500, 1/28, 3/25, 7/50, etc., of an inch.

In giving the etiology of the various diseases of the eye and ear unimportant or doubtful factors are in many cases stated first and the essential factors entirely ignored. For instance, in iritis, injuries and *cold* (?) are mentioned before the important factors of syphilis and rheumatism, etc. The same occurs in reference to retinitis, when exposed to bright light and continued occupation in fine work are given first. Diabetes as a factor is entirely ignored and the authors discuss the subject as if every retinitis had the same pathological picture. What little pathology the book contains is faulty. Chalazion is attributed to an obstruction of the Meibomian duct. No mention is made of the part played by the xerosis bacillus in setting up an inflammation of the gland. The reader is led to believe that the increase of intra-ocular fluids causes glaucoma. We confess we do not understand the following sentence which occurs in the ear section, p. 277: "If a chronic suppuration is advancing and cannot be kept in an aseptic condition an operation is indicated." Trachoma is said to be a result of catarrhal, purulent or diphtheritic conjunctivitis. We cannot see the purpose of the authors in differentiating a purulent conjunctivitis, which they say is due to the gonococcus, from a gonorrhœal conjunctivitis. On page 96 the authors state that the exophthalmos of exophthalmic goitre disappears when treatment is directed to the *cardiac* disease (?).

In regard to treatment, no mention is made of the value of anti-diphtheritic serum in diphtheritic conjunctivitis, or of boracic acid in aspergillus of the auditory canal. We do not approve of opening a chalazion through the skin of the lid. In regard to "mastoid affections," on page 271, we read that mastoid periostitis often arises in suppuration of the middle ear and the authors advise an incision of the tissues down to the bone. This is very bad surgery which has properly fallen into disrepute, for we now know that practically every case requiring this incision will have associated with it some suppurative foci in the mastoid cells, antrum, attic, etc., and a simple incision through the superficial tissues will not clean these out.

The general arrangement of subject matter is not good and too much space is given to at least two conditions which do not exist as clinical entities, viz.: Epilepsy of the retina and chronic proliferous inflammation of the middle ear (Roosa).

As an example of the very careless way in which the book has been written we will mention the fact that on page 37, in describing the anatomy of the lachrimal ducts, the direction is given as downwards, outwards and *backwards*, which is correct, and yet in passing the probes it is stated they should be passed downwards, outwards and *forwards*.

The various refractive errors of the eye are discussed in such a fragmentary way as to be entirely devoid of worth.

B. B. B., Jr.

How to Cook for the Sick and Convalescent. Arranged for the physician, trained nurse and home use. By Helena V. Sachse. 2nd edition, revised and enlarged. (*Philadelphia: J. B. Lippincott Company, 1904.*)

This little volume opens with a most valuable classification of recipes according to composition, food value and character of the food materials. It contains also some helpful, though brief points on the preparation of the tray for the invalid. Aside from this, the book consists almost entirely of recipes which do not differ in any notable respect from those previously published. Being individual recipes, however, they are particularly valuable to the nurse who prepares the food for her patient.

The chapter on home modification of milk is of small practical value since the subject is so little understood by the average woman, and because the process requires more time than can be devoted to it in most homes.

M. H. J.

A Manual of Clinical Diagnosis. By Charles E. Simon, M. D. Fifth edition, thoroughly revised and enlarged. (*Philadelphia and New York: Lea Brothers & Co., 1904.*)

This work has been much enlarged in this edition by the addition of the recent work on this subject, with many new illustrations. The book is a very complete one.

The Students Handbook of Surgical Operations. By Sir Frederick Treves, Bart, K. C. V. O., C. B., LL. D., F. R. C. S., Sergeant Surgeon-in-Ordinary to the King, etc., Consulting Surgeon to the London Hospital. New edition, revised by the author and Jonathan Hutchinson, Jun., F. R. C. S., Surgeon to the London Hospital, etc. 486 pages. 121 illustrations. Abridged from the last edition of the author's "Manual of Operative Surgery." (*Chicago: W. T. Keener & Co., 1904.*)

This handbook, as the author states in the preface, "concerns itself only with the most essential and the most commonly performed operations. All matters save such as deal with the actual technical details of Operative Surgery have been omitted. The General Principles of Operative Surgery or the consideration of the value of the various methods are not taken up."

More than half the book is given up to the various ligations, amputations and excisions, which are considered quite at length, while the operations on the abdomen, hernia, bladder, etc., etc., are concisely described for the most part.

There is no reference made to the surgery of the thorax, and several essential and important major operations commonly performed in this country are not mentioned.

Lists of the instruments required are given for each operation, which is a convenience for the student.

The illustrations are nearly all diagramatic and aid considerably in following the text.

The work is primarily intended for students who are preparing for their final examinations, or for those who need a book to assist them in carrying out operations on the cadaver. It is nicely gotten up, with flexible binding, is of convenient size and, on the whole, seems suitable for the part it is intended to play.

Refraction and How to Refract, including sections on optics, retinoscopy, the fitting of spectacles and eye-glasses, etc. By James Thorington, A. M., M. D., Professor of Diseases of the Eye in the Philadelphia Polyclinic, etc. Third edition. 215 illustrations. (*Philadelphia: P. Blackiston's Son & Co., 1904.*)

This is the 3rd edtion of Thorington's book on refraction. Very few changes are noted in this edition in subject matter, general arrangement or additions. The definitions of the various terms used in optics and refraction are good. The book, however, is too dogmatic, some important facts are not explained and some of the explanations when given are faulty. To illustrate, we quote the following from the author: "Each vessel in the eyeground of an astigmatic (?) eye is seen clearest through the meridian at right angles to its course. This is a puzzle to the beginner but he must remember that cylinders refract opposite to their axes" (page 153). We do not consider this an explanation to the puzzled student.

The book retains a number of puerile statements, such as "Eyes in which the myopia is progressive are spoken of as *sick eyes*" (p. 115), and when one of the ways of quickly diagnosing simulates myopia in hypermetropia is given as (page 111) "The fact that very few children have myopia," which is not very conclusive. The ophthalmoscope is not of value in diagnosing this condition, as the author suggests.

In regard to correcting muscle errors, no mention is made of the importance of *fully* correcting the hypermetropia in esophoria and undercorrecting it in exophoria.

If one's entire knowledge of "Refraction and How to Refract" had to be obtained from this book, it is to be feared that he would have a very imperfect understanding of an important branch of ophthalmology.

B. B. B., Jr.

A System of Practical Surgery. By Prof. E. von Bergmann, Prof. P. von Bruns and Prof. J. von Mikulicz. Vol. IV. Translated and edited by William T. Bull, M. D., Professor of Surgery, Columbia University, New York, and others. Surgery of the Alimentary Tract. (*New York and Philadelphia: Lea Brothers & Co., 1904.*)

This volume contains 739 pages. It deals with the surgery of the alimentary tract, and includes the chapter on the surgery of the œsophagus and the chapter on hernia, which appeared in Volumes II and III, respectively, of the second German edition.

The criticism of Volume II, which appeared in the Bulletin for September, 1904, is equally applicable to this volume. The book is essentially an Americanized edition, which, sad to relate, has lost somewhat of the dignity of the original. More attention is devoted to the operative side of the subject, while many important passages are omitted. The passages in fine print, which appear in the original and which contain a great deal of valuable information, are lost. With the above exceptions, the translation adheres closely to the German text, but is only moderately well done, the sense at times being rather obscure.

The references to the literature have been entirely omitted. The best chapters are probably those on the œsophagus by von Hacker, and those on the surgery of the stomach by Mikulicz.

The volume, however, will give those who do not read German a fair idea of the value and completeness of the original.

Beauty Through Hygiene. Common Sense Ways to Health for Girls. Illustrated. By Emma E. Walker, M. D. (*New York: A. S. Barnes & Co., 1904.*)

This sensible, well-written little volume is one of a series entitled the "Womans Home Library." It is designed to teach girls how to secure and to maintain good health. The chapters on "Deep Breathing," "Exercise for Healthy Girls," and "Bathing," are to be especially commended. The book is written with delicacy and good taste and is fit for a young girl to read. It has an excellent index.

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